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我国东北地区第一个老第三纪哺乳动物群的研究

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关键词 吉林桦甸 老第三纪 食虫目 灵长目 啮齿目

内 容 提 要

本文记述了在我国东北地区首次发现的老第三纪哺乳动物群——吉林桦甸哺乳动物群。计有食虫目盔猬亚科的中华晓猬（新属、新种）*Eochenus sinensis* gen. et sp. nov.，桦甸齿鼩猬(新种）*Tupaiodon huadianensis* sp. nov.，鼩鼱科的吉林蕾鼩（新属、新种）*Ernosorex jilinensis* gen. et sp. nov.，灵长目始镜亚科的长白亚洲镜猴(新属、新种)*Asiomomys changbaicus* gen. et sp. nov. 和啮齿目先松鼠科的东方争胜鼠（新属、新种）*Zelomys orientalis* gen. et sp. nov. 和纤细争胜鼠（新种）*Z. gracilis* sp. nov. 等。其中 *Eochenus* 可能代表目前已知最原始的盔猬类。*Ernosorex* 可能是鼩鼱类具有原始特征的旁枝。桦甸哺乳动物群与北美尤因他动物群的关系较近，而与欧洲同期的不同。表明当时亚洲与北美之间有直接的动物群交流。其中争胜鼠可能由北美迁来，而鼩鼱类可能从亚洲起源，然后迁往北美。桦甸动物群的时代为晚中始新世或晚始新世。当时桦甸盆地为森林沼泽湖泊景观，气候较温暖潮湿。

一、前 言

我国东北地区产有丰富的老第三纪煤系和油页岩。然而，人们对该地区老第三纪哺乳动物的情况却是一无所知。1984年吉林省地质矿产局区域地质矿产调查所在吉林省中部的桦甸盆地(图 1）公郎头油母页岩矿区发现了一批脊椎动物化石，其中有一块哺乳动物化石。这不仅是老第三纪哺乳动物化石在吉林桦甸盆地中的第一次发现，而且在整个东北地区也属首次。这一发现为东北地区老第三纪哺乳动物的研究开辟了新的篇章。同年，他们又多次前去采集，获得了一些相当好的哺乳动物化石材料。1985年，吉林省地质矿产局区域地质矿产调查所与中国科学院古脊椎动物与古人类研究所组成联合调查队[1]在该地区再次考察，在公吉屯大勃吉公社油页岩矿区又采集了一些好的哺乳动物化石标本。

老第三纪哺乳动物群在吉林桦甸的发现不仅对确定桦甸盆地油页岩和煤系地层时

1）参加该队的还有吉林省地矿局地矿所的张普林、吕宝田、孙嘉儒、刘爱和中国科学院古脊椎动物与古人类研究所的周家健同志。

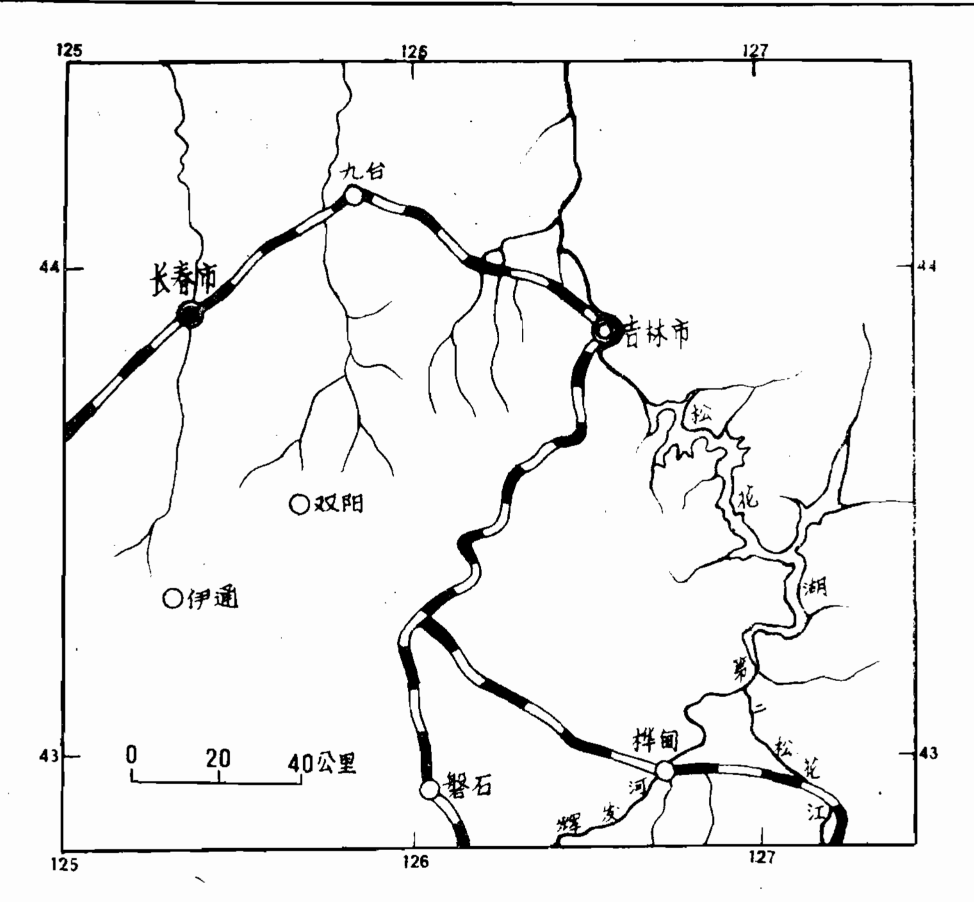


图1 吉林省桦甸县交通位置图 (Location of Huadian County, Jilin Province)

代，当时桦甸地区古地理、古气候有重要意义，而且对了解早第三纪时我国东北地区哺乳动物群的性质和它与亚洲其他地区，以及欧洲、北美等大陆的关系都有重要意义。此外，还为我国老第三纪哺乳动物群增加了新的门类，并为研究某些门类的起源和分布提供了新的、极有价值的资料。

美国纽约自然历史博物馆 R. H. Tedford 博士，美国芝加哥 Field 自然历史博物馆 W. D. Turnbull 博士及时寄来了所需对比的标本模型，地科院孙孟蓉同志帮助分析孢粉资料，古脊椎所翟人杰、李传夔、邱占祥、童永生和老第三纪研究组的其他同志帮助审阅手稿，并提出了有益的建议，陆庆伍和金昌柱同志帮助翻译有关日文资料，胡惠清和刘增同志绘图，张杰同志照相，在此表示感谢!

二、桦甸盆地地质概况

桦甸盆地为一小型内陆断陷盆地。基底由太古界鞍山群、二叠系及华力西晚期花岗岩组成。盆地的东南部沉积了侏罗系和白垩系。下第三系桦甸组沉积在盆地的西北部，不整合在下白垩统黑崴子组之上。其上被上第三系土门子组覆盖。桦甸组岩层呈东西向展布，东西向出露的最大长度约 18 公里，南北向最大宽度约 8.5 公里。出露面积约 80 平

方公里(图 2)。该地区新构造运动活跃，北东一南西向和东西向断裂活动不但切割了桦甸组，而且现在还在活动。

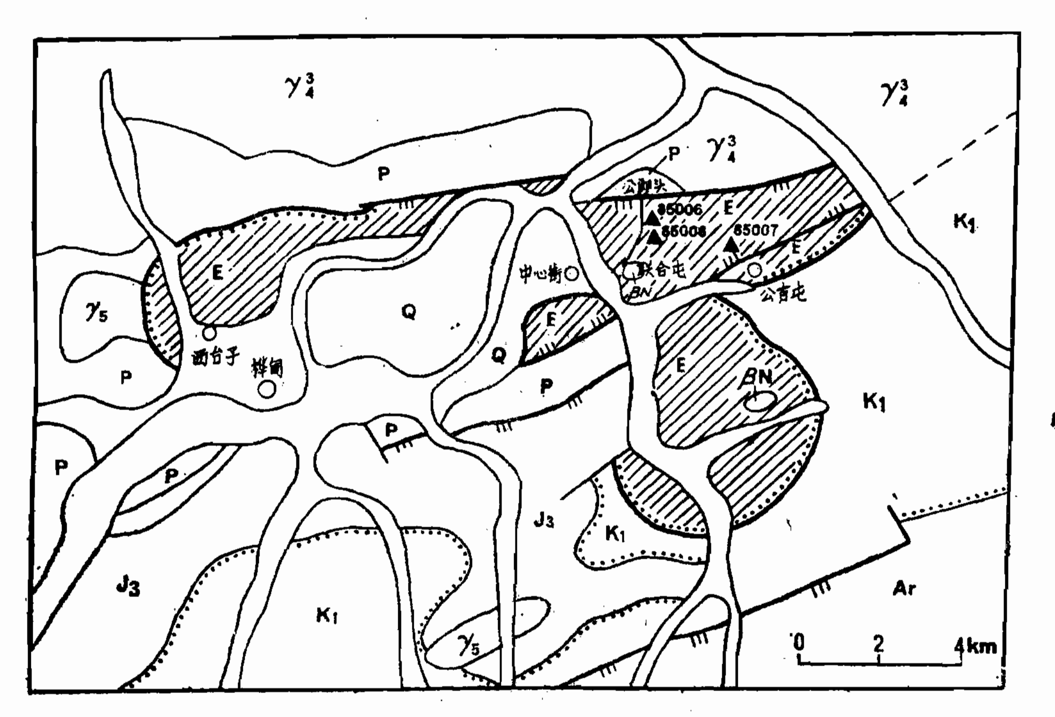


图 2　吉林桦甸盆地地质略图(依张普林等，1986，稍修改)

(Geological sketch of Huadian Basin. Adapted from Zhang et al., 1986)

Q 第四系 (Quaternary); βN 上第三系船山玄武岩 (Neogene Chuanshan Basalt); E 桦甸组 (Huadian Formation); K_1 白垩系下统 (Lower Cretaceous); J_3 侏罗系上统 (Upper Jurassic); P 二叠系 (Permian); Ar 太古界鞍山群 (Archean Anshan Group); γ_5 燕山期花岗岩 (Yanshan Granite); γ_4^3 华力西晚期花岗岩 (Late Wallace Granite); ▲化石产地 (fossil site)

桦甸组的岩性主要为灰白色、灰色和灰绿色含砾粗砂岩、中粗粒砂岩、细砂岩、粉砂岩、粉砂质泥岩夹油页岩和褐煤层。岩层总厚 1959 米。可分为四个岩性段(自上往下):

第 IV 岩性段：上部：灰白色中粗粒砂岩、含砾砂岩夹粉砂岩及泥质粉砂岩；下部：灰色砂岩、粉砂岩为主，富含褐色油页岩。产哺乳类：*Eochenus sinensis* gen. et sp. nov. 和 Rodentia indet.; 鱼类：Clupeiformes 和 Amiidae; 鸟类：Corvidae 和大量腹足类化石。厚约 1233 米。

第 III 岩性段：灰色、灰绿色厚层状泥岩、泥质粉砂岩夹可采油页岩和褐煤。此段为主要含化石层。哺乳动物化石有食虫类：*Eochenus sinensis* gen. et sp. nov., *Tupaiodon huadianensis* sp. nov., *Ernosorex jilinensis* gen. et sp., 啮齿类：*Zelomys orientalis* gen. et sp. nov., *Z. gracilis* sp. nov. 和灵长类 *Asiomomys changbaicus* gen. et sp. nov. 以及 Mammalia indet. 等。此外，还有爬行类 Agamidae gen. et sp. nov., 鸟类 Threskiornithidae gen. et sp. nov. Anatidae gen. et sp. nov., 鱼类 Perciformes, Amiidae,

Catostomidae 和 Clupeiformes，以及大量的腹足类和孢粉化石。厚约 578 米。

第 II 岩性段：黄褐色粗砂岩、砂岩、粉砂岩夹杂色砂岩、泥岩和油页岩。厚约 138 米。

第 I 岩性段：灰色、黄褐色粗砂岩和含砾粗砂岩。厚度大于 10 米。

三、化石记述

食虫目 Insectivora Cuvier, 1817

刺猬科 Erinaceidae Fischer von Waldheim, 1817

盔猬亚科 Galericinae Pomel, 1848

中华晓猬(新属、新种) *Eochenus sinensis* gen. et sp. nov.

(图 4, 5; 图版 I;II,1a,1b,4)

正型标本 左下颌具 I_{2-3}, C_1 和 P_2-M_3 (古脊椎动物与古人类研究所化石编号 V 8786)。

归入标本 七枚下颌骨 (V8787-V8792 和 V8794) 和一枚右上颌骨具 C^1, P^1, P^4 和 M^{2-3}(V8793)。

产地和层位 吉林桦甸县公吉屯大勃吉油母页岩矿 (古脊椎动物与古人类研究所野外地点编号: 85007: V8786-V8789) 和公郎头油母页岩矿 (85006: V8790-V8793) 和村井 (85008: V8794); 桦甸组第 III 岩性段 (V 8786-V8793) 和第 IV 岩性段 (V 8794)。

特征 尺寸与 *Tetracus* 相近，下颌骨较粗壮，颏孔位于 P_2 或 P_3 下方；齿式 $\frac{?\ 1\ 4\ 3}{3\ 1\ 4\ 3}$；下门齿双叶型，$I_2$ 明显大于 I_1 和 I_3；颊齿齿冠较低，齿尖钝圆；P_1 单齿根，P_{2-4} 双齿根；P_3 很小，仅稍大于 P_2，而比 P_4 小很多；P_4 下前尖和下后尖同样发育，跟座短；下臼齿三角座较短，下后尖正位于下原尖舌侧，无明显的下后脊；下次小尖从 M_1 至 M_3 由无到发达；下前脊在 M_1 直而短，较少前伸；在 M_{2-3} 较矮，呈弧形；C^1-P^3 均为双齿根，P^4 三齿根；M^2 宽大于长，两小尖都发育，次尖丘形，有弱棱与后齿带和原尖后棱相连；M^3 三角形，具五尖，原小尖和后小尖均发达(颊齿结构名称见图 3)。

名称来源 Eos "希"，黎明的，东方的；chenus，"希"，刺猬。意为该动物是在东方发现的较原始的刺猬。

描述 身材与 *Tetracus* 相近。下颌(图 4)骨体长而粗壮，下缘呈前凸后凹的 S 形。多数标本只有单一颏孔，位于 P_3 下方，但在 V 8787 位于 P_2 下方。另外，V 8791 有两颏孔：在 P_3 下方的较大，在 P_2 下方的较小。冠状突前缘陡直。下颌髁位置很低，仅比牙列稍高. 下颌角主要向后伸，位置比牙列稍低。下颌孔约与牙列在同一水平上，从该孔有一脊伸达冠状突前缘基部。

齿式 $\frac{?\ 1\ 4\ 3}{3\ 1\ 4\ 3}$。仅正型标本 (V 8786) 保存有下门齿。$I_1$ 未保存，其齿槽窄小。I_2 最大(可惜其齿冠在修整时被损坏)。I_3 很小。I_2 和 I_3 均为双叶型。主叶大，呈顶端稍尖

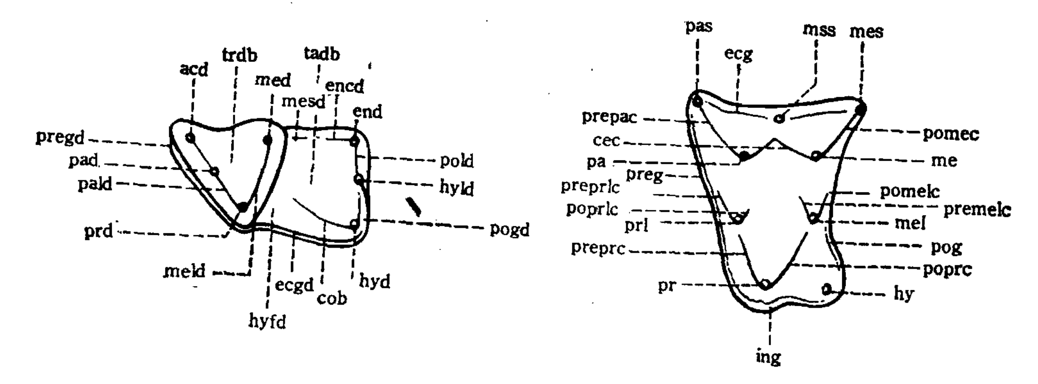


图 3　食虫目颊齿结构名称 (Dental Terminology of Insectivora)

左：下臼齿 (Left: lower molar)

acd anteroconid 下前边尖，cob cristid oblique 下斜脊，ecgd ectocingulid 下外齿带，encd entocristid 下内尖棱，end entoconid 下内尖，hyd hypoconid 下次尖，hyfd hypoflexid 下次凹，hyld hypoconulid 下次小尖，med metaconid 下后尖，meld metalophid 下后脊，mesd metastylid 下后附尖，pad paraconid 下前尖，pald paralophid 下前脊，pogd postcingulid 下后齿带，pold posterolophid 下后边脊，prd protoconid 下原尖，pregd precingulid 下前齿带，tadb talonid basin 下跟座盆，trdb trigonid basin 下三角座盆。

右：上臼齿 (right: upper molar)

cec centrocrista 中央棱，ecg ectocingulum 外齿带，hy hypocone 次尖，ing inner cingulum 内齿带，me metacone 后尖，mel metaconule 后小尖，mes metastyle 后附尖，mss mesostyle 中附尖，pa paracone 前尖，pas parastyle 前附尖，pog postcingulum 后齿带，pomec postmetacrista 后尖后棱，pomelc postmetaconucrista 后小尖后棱，poprc postprotocrista 原尖后棱，poprlc postprotoconucrista 原小尖后棱，pr protocone 原尖，preg precingulum 前齿带，premelc premetaconucrist 后小尖前棱，prepac preparacrista 前尖前棱，preprc preprotocrista 原尖前棱，preprlc preprotoconucrista 原小尖前棱，prl protoconule 原小尖

的舌形，侧叶很小。两叶间有切口和沟。

C_1 大，獠牙形，稍向前倾，顶端稍向后弯。

颊齿比例上较宽短。P_1 未保存，但在 C_1 和 P_2 间有一齿槽，说明 P_1 具单齿根。

P_2 主尖为钝的扁锥形。前侧较窄而坡陡，有纵棱。后侧较宽，坡较缓，无后纵棱。下前尖很低小。跟座为低矮而横宽的尖。无齿带。双齿根。

P_3 比 P_2 稍粗大。主尖前后对称，具明显的后纵棱。下前尖明显。跟座呈横脊形。齿带沿齿的前缘、内缘和后缘连续分布。无外齿带。

P_4 下原尖高而粗壮，顶端稍向后弯。前棱圆凸，往基部变明显。下前尖的高约为下原尖的一半。下后尖位于下原尖后内侧，发育程度与下前尖相近。跟座呈横脊形。外齿带或多或少连续分布，并与后齿带相连。

下臼齿从 M_1 到 M_3 逐渐变小，主尖钝圆。

M_1 约呈梯形，舌面平直。三角座短。下原尖高大。下后尖稍低，位于其舌侧。两尖

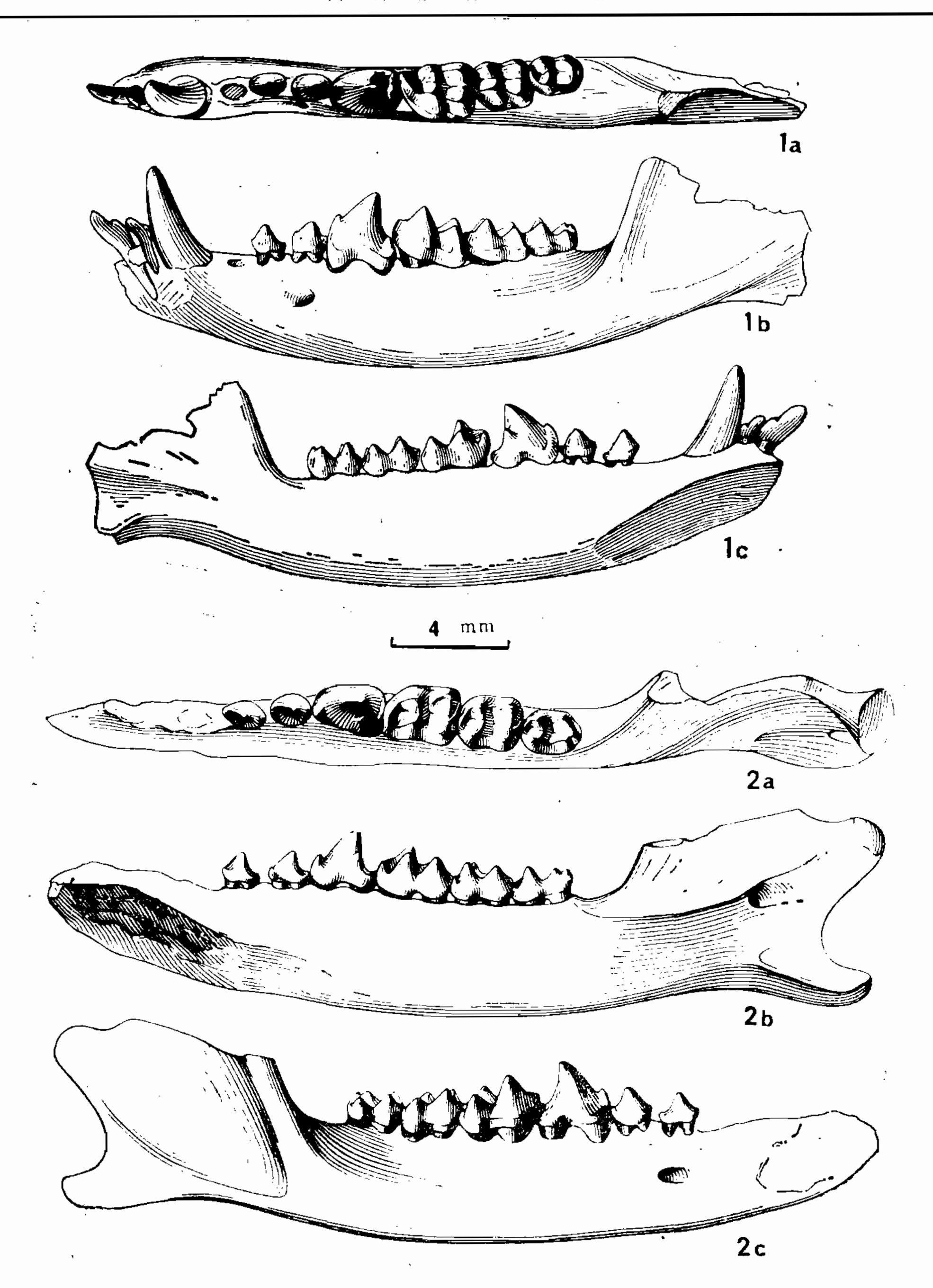


图 4 *Eochenus sinensis* gen. et sp. nov.

1. 正型标本 (holotype) 左下颌骨具 I_{2-3}, C_1 和 P_2-M_3 (left lower jaw with I_{2-3}, C_1 and P_2-M_3), V8786

a. 嚼面观 (occlusal view); b. 唇面观 (labial view); c. 舌面观 (lingual view);

2. 右下颌骨具 P_2-M_3 (right lower jaw with P_2-M_3), V8787

a. 嚼面观 (occlusal view); b. 舌面观 (lingual view); c. 唇面观 (labial view)

以V形谷分开，无下后脊，但具下后尖棱。下前脊长而直，向前舌侧，主要向舌侧伸。下前

边尖明显或不明显，与下后尖和下内尖在同一直线上。跟座较宽短。下内尖和下次尖相对，位于齿的后端。下内尖具下内尖棱，有时与下后尖棱基部相连。下次尖V形。下次凹浅。下后边脊上无明显的下次小尖。下跟座盆较开阔，内侧开口为V形。前齿带和外齿带连续分布，后齿带从后边脊中部斜向外下方伸，通常不与外齿带相连。无内齿带。

M_2 较 M_1 小。下前脊较低而短，舌端向后下方弯。下后尖的形状和尺寸与下原尖的相近。三角座盆较窄小。下跟座盆更开阔。下次小尖或多或少明显，位于下后边脊中部。

M_3 比 M_2 小，但比例上较窄长，约呈卵圆形。下次小尖发达，尺寸和形状与下内尖相近，在纵轴内侧有时靠近下内尖，两尖几乎形成双尖型；有时靠近纵轴，与下内尖间的谷较深而开阔，而与下次尖间的谷相对变小了。下后边脊弱。后齿带仅在下次尖与下次小尖间发育。

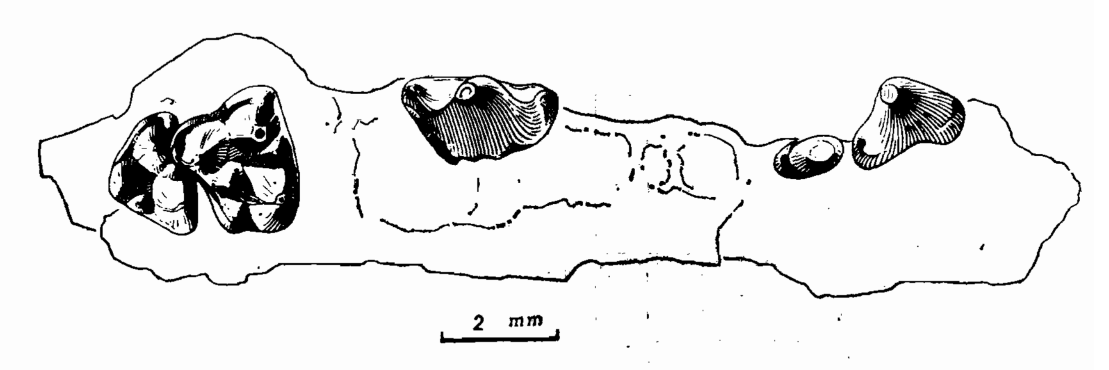


图 5　*Eochenus sinensis* gen. et sp. nov.
上颌骨具 C^1, P^1, P^4 和 M^{2-3} (upper jaw with C^1, P^1, P^4 and M^{2-3}), V8793，嚼面观 (occlusal view)

上齿列保存不全(图 5):

C^1 大，呈前后伸长的扁锥形。顶端稍向后弯，稍磨蚀。前侧陡直，基部有一小尖。后侧稍长稍凹，其基部尖较大。具双齿根。

P^1 形状与 C^1 的相似，但小得多。顶端已被磨蚀掉。具两齿根。

P^4 仅保存有齿冠外部。前尖高耸呈圆锥形。前尖后棱与后附尖棱相连形成切脊。无前尖前棱。前附尖低，只与前齿带相连。外齿带和后齿带发达。具两外齿根。

M^2 呈四边形，横宽大于前后长，前缘宽于后缘。前尖和后尖大小相近，均呈钝圆锥形。前尖前棱直。中央棱低而直。后尖后棱呈弧形，伸达牙齿的后外角。前附尖区破损。后附尖不明显。原尖较前尖和后尖高大。原尖前棱较高，伸达原小尖。原尖后棱低，伸达后小尖。两小尖均呈三角锥形。原小尖稍小，其前棱较后棱长，伸达前齿带。后小尖具短而明显的前棱和后棱。次尖丘形，比原尖小得多，有弱的棱伸达原尖后棱和后齿带。前齿带、外齿带和后齿带发达。内齿带弱。具三齿根。

M^3 呈三角形。后尖后棱、后附尖和次尖都完全消失。后尖位于前尖后舌侧，牙齿的后外角。两小尖仍较发达。后小尖呈圆锥形，位于齿的后缘。后齿带很弱。具三齿根。

比较　*Eochenus* 在下颌骨体较长，下颌髁和角突位置很低，齿式完全，M^3_3 较少退化，P_4 下前尖较少发育，M_1 下前脊较长而直，下次凹浅，M_{2-3} 下前边尖不明显，上臼齿次尖

表 1 中华晓猬(新属、新种) *Eochenus sinensis* gen. et sp. nov. 颊齿测量(单位：毫米)

下颌 (lower jaw)

		N	min.	mean	max.
P_2-M_3 长 (L)		3	10.40	10.67	11.20
P_4-M_3 长 (L)		7	7.92	8.13	8.48
P_2-P_4 长 (L)		3	4.16	4.69	5.12
M_1-M_3 长 (L)		8	5.84	6.11	6.48
C_1	长 (L)	1		1.76	
	宽 (W)	1		1.28	
I_2	长 (L)	1		0.64	
	宽 (W)	1		0.96	
I_3	长 (L)	1		0.64	
	宽 (W)	1		0.64	
P_1	长 (L)	1		0.80[1)]	
	宽 (W)	1		0.80[1)]	
P_2	长 (L)	3	0.80	1.07	1.28
	宽 (W)	3	0.72	0.77	0.80
P_3	长 (L)	3	1.12	1.25	1.36
	宽 (W)	3	0.96	0.96	0.96
P_4	长 (L)	7	1.92	2.17	2.40
	宽 (W)	7	1.12	1.49	1.76
M_1	长 (L)	8	2.24	2.36	2.56
	宽 (W) 三角座 (trid)	8	1.60	1.73	1.92
	宽 (W) 跟座 (tad)	7	1.76	1.85	2.08
M_2	长 (L)	8	1.76	2.01	2.16
	宽 (W) 三角座 (trid)	8	1.44	1.64	1.84
	宽 (W) 跟座 (tad)	8	1.60	1.72	1.92
M_3	长 (L)	8	1.76	1.89	2.00
	(W) 三角座 (trid)	8	1.20	1.29	1.44
	(W) 跟座 (tad)	7	1.20	1.26	1.36

上颌 (upper jaw)

		V8793
P^4-M^3 长(L)		7.04
C^1	长 (L)	1.76
	宽(W)	0.80
P^1	长 (L)	1.12
	宽(W)	0.64
P^4	长 (L)	2.32
M^2	长 (L)	1.92
	宽(W)	2.56
M^3	长 (L)	1.28
	宽(W)	1.92

1) 根据齿槽测量。

有脊与原尖后棱相连等特点都与盔猬亚科的一致。

在盔猬亚科中，*Eochenus* 在 M_1 较短，特别是三角座较短，下前脊较少前伸，M_3 具下次小尖等特点上与 *Tupaiodon* 相似，而与其他各属不同。但是，*Eochenus* 却在上臼齿比例上较窄长，具明显的原小尖，P_3 小而简单，P_4 下前尖和下后尖都不很发达，下臼齿

三角座与跟座高差较小，三角座较正，下后尖正位于下原尖舌侧，M_{2-3} 下前脊较少发育等特点上与 *Tetracus* 和 *Galerix* 相似，而与 *Tupaiodon* 相区别。此外，*Eochenus* 的颊齿较粗壮，齿冠较低和齿尖较钝圆的特点也与 *Tupaiodon* 的不同。*Eochenus* 与 *Tetracus* 的不同还在于颏孔位于 P_3 下方；与 *Galerix* 的区别还有：颏孔位置靠前，门齿为双叶型，次折较深，M^2 次尖较小，M^3 具五尖，原小尖和后小尖都很发达等。

综合分析 *Eochenus* 的特点，我们发现 *Eochenus* 与 *Tupaiodon* 的相似特征均为原始特征。而 *Eochenus* 在前臼齿和臼齿三角座的形态上却和 *Tetracus* 及 *Galerix* 一样，缺乏 *Tupaiodon* 所有的特化特征。从这些特征看，*Eochenus* 很可能与 *Tetracus* 和 *Galerix* 有较近的关系。当然，*Eochenus* 要比这两属原始得多。这似乎表明 *Eochenus* 代表目前已知最原始的盔猬类。

桦甸齿鼩猬（新种）*Tupaiodon huadianensis* sp. nov.

（图 6；图版 III，1a，1b，2）

正型标本　右下颌骨具 P_4，M_1 和 M_3（V8795）。

地点和层位　公吉屯大勃吉油母页岩矿（85007）；桦甸组第 III 岩性段。

特征　身材介于 *Tupaiodon morrisi* 和 ?*T. minutus* 之间，颊齿齿冠较低，齿尖和齿脊较钝，P_4 下前脊横向发育，P_4-M_3 下前边尖和下前尖或多或少明显，下后尖正位于下原尖舌侧，M_1 三角座不特别缩短，也不向前斜，M_3 下前脊短，呈圆弧形，下后尖比下原尖高。下臼齿具明显的外齿带。

名称来源　Huadian，桦甸，为产化石地点所在的县的名称。

描述　下颌（图 6）骨体细长，下缘平直。颏孔位于 P_3 的下方。P_4 前有 8 个齿槽。最前边的三个可能是门齿的。I_1 的齿槽大，I_2 和 I_3 的齿槽非常小，呈前后扁的卵圆形。第四个齿槽较大，圆形，可能是 C_1 的。C_1 后的两个齿槽比 C_1 的稍小，均呈前后稍扁的圆形，后齿槽稍宽。它们可能分属 P_1 和 P_2 的；也可能都是 P_2 的，即 P_2 具二齿根，而 P_1 已消失了。笔者趋向于接受前一种可能性：P_1 和 P_2 都存在，都具单齿根。P_4 前的两齿槽较大，可能是 P_3 的。

P_4 唇侧大部分破损。从保存部分看，P_4 次臼齿化。下前尖和下前边尖都很发达，并相连形成横向的下前脊，但不与下原尖相连。下后尖很高大。下三角座盆已形成，向舌侧开口。跟座横脊形，几乎与下前尖等高。

M_1 呈长方形。三角座短，约与跟座等宽，不向前斜。下前边尖明显。下后尖比下原尖低小，但高于下前边尖，位于下原尖舌侧，以 V 形谷与后者分开。无下后脊。跟座稍低。下次尖 V 形。下次凹浅，下后边脊完全。下内尖破损。跟座盆开阔。外齿带与前齿带连续发育，只在次尖基部消失。后齿带在后面外侧发育，内端与下后边脊相连。

M_3 三角座呈横卵圆形。下后尖较下原尖高大。下前脊呈圆弧形，非常低。下前尖和下前边尖或多或少明显。三角座盆窄而浅。跟座大部分破损。下次尖低于下原尖。斜脊前伸，下次凹较 M_1 的浅。前齿带和外齿带连续发育。

比较与讨论　V8795 标本在齿式、P_4 次臼齿化和 M_1 三角座短，无下后脊的特点上与 *Tupaiodon* 的一致。V 8795 与 *Tupaiodon* 已知种 *T. morrisi* 和 ?*T. minutus* 的

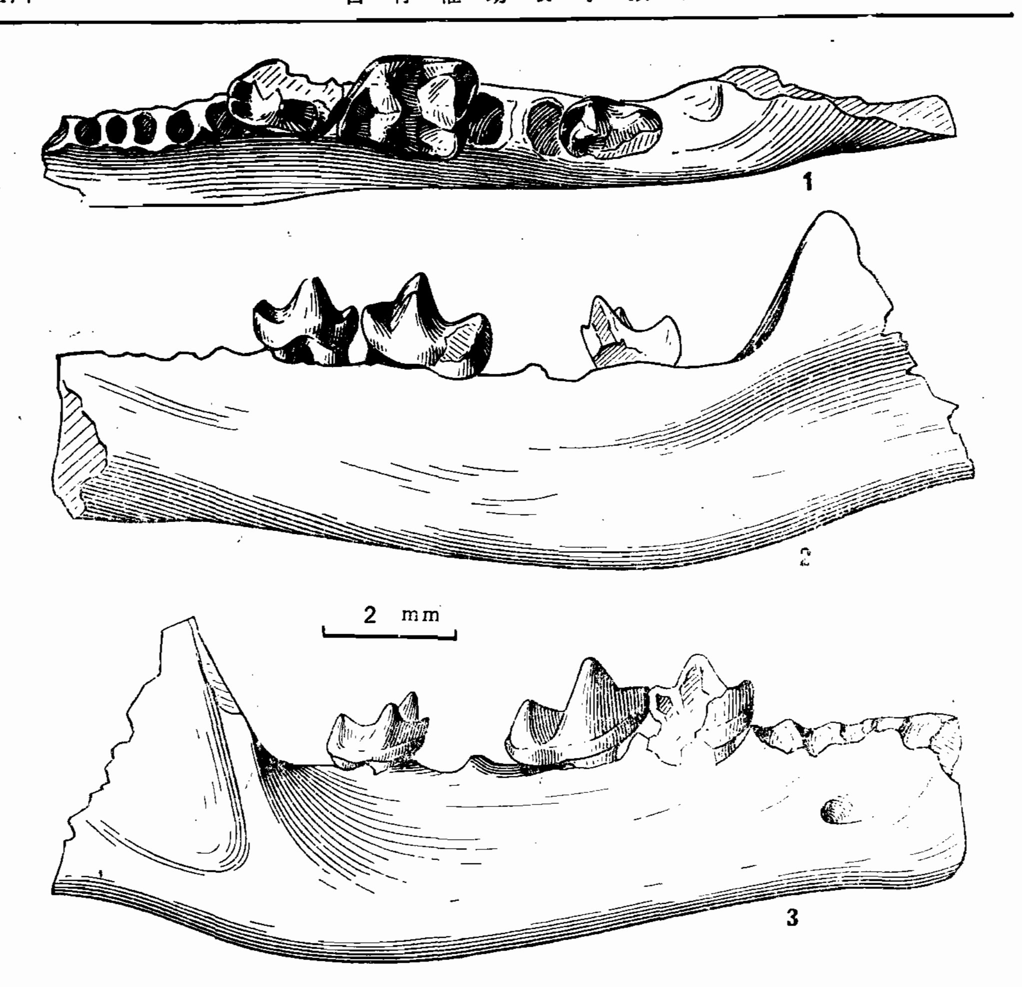


图 6 *Tupaiodon huadianensis* sp. nov. 正型标本 (holotype): 右下颌骨具 P_4, M_1 和 M_3 (right lower jaw with P_4, M_1 and M_3, V 8795) 1. 嚼面观 (occlusal view); 2.舌面观 (lingual view); 3.唇面观 (labial view)

表 2 桦甸齿鼩猬(新种) *Tupaiodon huadianensis* sp. nov.
正型标本 (holotype: V 8795) 测量(单位: 毫米)

		P_4-M_3	M_1-M_3	P_4	M_1	M_3
下颌骨高 (H. of l. jaw)				2.24	2.24	
长 (L)		6.40_e	4.80_e	1.64	1.84	
宽(W)	三角座 (trid)				1.44	0.94
	跟 座 (tad)				1.44	

区别为: 颊齿齿冠较低, 齿尖和齿脊较钝; P_4-M_3 下前边尖和下前尖明显; P_4 下前脊呈横的弧形, 跟座较高; M_1 三角座前后较少缩短, 下后尖位于下原尖舌侧; M_3 下前脊较短,

呈圆弧形等。此外，下臼齿具外齿带的特点与 *T. morrisi* 的不同。它的颏孔位置比？*T. minutus* 的稍靠前等。V 8795 的这些特点多半是较原始的特点，很可能它代表 *Tupaiodon* 属的一较原始的新种：*Tupaiodon huadianensis*。此外，V 8795 在颊齿齿冠较低，尖和脊较钝，P_4 下前脊较横向，跟座较高，M_{2-3} 下前脊较低而弯曲，无下后脊等特点上与 *Ictopidium lechei* 区别。

关于 *Ictopidium* 与 *Tupaiodon* 的关系

Tupaiodon 是 Matthew 和 Granger 于 1924 年建立的。而 *Ictopidium* 是 Zdansky (1930) 描述的。Zdansky 在鉴定 *Ictopidium* 时并未提及 *Tupaiodon*。1969 年 Sulimski 在将新种 *tatalgolensis* 归入 *Ictopidium* 属时，分析了 *Ictopidium* 和 *Tupaiodon* 的异同点。他认为两属的区别是：(1) 齿式不同，前者具三个前臼齿，而后者具四个前臼齿；(2) *Ictopidium* 具单齿根的犬齿；(3) *Ictopidium* 下颌骨前面牙齿之间缺少齿间隙等。与此同时，他也指出了 *Tupaiodon* 的前臼齿与 *Ictopidium* 的相似。他还认为 *Tupaiodon minutus* 可能也属于 *Ictopidium* 属。Russell 和 Zhai (1987, P. 305, P. 324) 则进一步认为 *Ictopidium tatalgolensis* 就是 *Tupaiodon*? *minutus* 的同物异名。

在详细地比较了 *Ictopidium* 和 *Tupaiodon* 的有关标本后，笔者发现 *Ictopidium lechei* 的颊齿的形态结构，如 P_3 齿冠较复杂，具次三角座和横脊状跟座；P_4 次臼齿化；下臼齿三角座短，M_{2-3} 下前边尖不很明显，M_3 下次小尖靠近齿的纵轴的内侧，以及各牙齿间的比例都与 *Tupaiodon* 的很相似。至于 Sulimski 所强调的两属的区别，我们将作较详细的讨论。

首先，关于 *Ictopidium lechei* 的齿式。Zdansky (1930) 分析它的齿式为 $\overline{?143}$，并估计至少有两个门齿，P_3 前的三个齿槽是 P_1 和 P_2 的：最前面的较大的齿槽是 P_1 的，后面两个齿槽是 P_2 的。Sulimski (1969) 则认为 *Ictopidium lechei* 缺 P_1，前面较大的齿槽是 C_1 的，后面两齿槽是 P_2 的，肯定了 *Ictopidium lechei* 的 P_2 具两齿根。笔者仔细观察了 *Ictopidium lechei* 正型标本的模型和照片，发现它的 P_3 以前的三个齿槽的情况与 V 8795 的很相似。笔者同意 Sulimski (1969) 的意见：前面较大的齿槽是 C_1 的。但认为后面两齿槽虽存在两种可能性：都是具双齿根的 P_2 的，或分别属于 P_1 和 P_2。但根据对刺猬科各属的观察，我们发现它们通常是在保存有 P_1 的情况下，P_2 才具有两齿根，而在 P_1 消失后，P_2 通常只具单齿根。而 P_1 和 P_2 同时为单齿根的情况是存在的。而且前后相邻的单齿根牙齿的齿槽可以紧密排列。因此，我们趋向于接受后一种可能性，即 *Ictopidium lechei* 和 *Tupaiodon huadianensis* 都具 P_1，而且 P_1 和 P_2 都是单齿根的。这样，*Ictopidium* 就有可能具四枚前臼齿了。

其次，关于犬齿齿根。*Tupaiodon* 只已知上犬齿具二齿根，而 *Ictopidium* 只已知下犬齿具单齿根。从刺猬科已知犬齿的情况看，刺猬亚科和 *Echinosorex*, *Hylomys*, *Neotetracus* 等属的 C^1 均为双齿根，而它们的 C_1 则为单齿根。因此，*Tupaiodon* 的 C_1 也可能是单齿根的。所以，笼统地将犬齿具单齿根作为 *Ictopidium* 与 *Tupaiodon* 的区别特征是不妥当的。至于第三点，前面牙齿之间的间距的特点，我们认为在两属中也未显出明显的区别。

由上面的分析可以看出，*Ictopidium* 的基本特征是与 *Tupaiodon* 的一致的。很可

能 *Ictopidium lechei* 应归入 *Tupaiodon* 属。这样，*Ictopidium* 很可能是 *Tupaiodon* 的同物异名。

关于 *Ictopidium tatalgolensis* 和 *Ictopidium lechei* 及 ?*Tupaiodon minutus* 的关系。应该指出的是 *I. tatalgolensis* 在颊齿的形态，特别是它的下颊齿的下后脊较发达的特点与 *I. lechei* 的很相似。如果 *I. lechei* 无 P_1，它的齿式就与 *I. tatalgolensis* 的一致，将这两种同归入 *Ictopidium* 属似乎还比较合理。如果上面关于 *Ictopidium* 具 P_1 和 P_2 的分析是正确的话，那么再将 *I. tatalgolensis* 归入 *Ictopidium* 就存在困难了。

至于 *I. tatalgolensis* 与 *Tupaiodon minutus* 的关系，两者虽在 P_3 和 P_4 的尺寸和形态特征上很相似，但它们之间仍有明显的区别。首先是 M_3 的特点的不同。*I. tatalgolensis* 的 M_3 不具下次小尖，而 ?*Tupaiodon minutus* 的 M_3 具发达的下次小尖。此外，*I. tatalgolensis* 的 P_4-M_3 具较发达的下后脊，M_1 较 P_4 大得多，而 M_3 比 M_2 小许多等特点都与 *T. minutus* 的不同。因此，*I. tatalgolensis* 应代表不同于 *Tupaiodon* 的另一属。

鼩鼱科 Soricidae (Fischer von Waldheim, 1817) Vicq d' Azyr, 1972

吉林蕾鼩(新属、新种) *Ernosorex jilinensis* gen. et sp. nov.

（图 7；图版 II, 2a, 2b, 3）

正型标本　左下颌骨具 I_{1-2}，C_1 和 P_4-M_1 (V 8796)。

产地和层位　公吉屯大勃吉公社油母页岩矿(85007)；桦甸组第 III 岩性段。

特征　身材中等的原始鼩鼱类。下颌骨前部不特别缩短，具二颏孔；齿式 $\overline{3\ 1\ ?3\ ?3}$；下门齿与下犬齿向前匍匐，呈覆瓦状排列；I_1 较大，顶端分成两叶；I_2 较小，具四个疣状突起；C_1 主尖位于齿的最前端，并具两后基部尖；P_4 三角座为单尖，呈高的三角锥形，跟座宽短，横脊形；M_1 三角座明显窄于跟座，下内尖横向稍扁，有下内尖棱与下后尖相连，下次凹很浅，下次小尖明显，后齿带从下次小尖开始往外下方伸。

名称来源　Ernos "希"、蕾、萌芽，sorex，"希"，鼩鼱，寓意该动物代表一种原始的、处于萌芽状态的鼩鼱。Jilin，吉林，为产化石地点所在省的名称。

描述　中等身材。下颌(图 7)骨较粗壮，水平支下缘较直。具二颏孔，前颏孔较大，位于 P_3 下方，后颏孔位于 P_4 下方。下颌联合部较长，伸达 P_3 下方。冠状突前缘较陡。齿式 $\overline{3\ 1\ ?3\ ?3}$。

I_1 最大，匍匐地向前伸。齿冠呈舌状，上部宽扁，顶端向舌侧弯，被深的切迹分成两叶，内叶较外叶高而大。齿冠下部横向变窄，唇舌向逐渐加厚。牙齿被四条棱分成四个面。唇面圆凸，舌面纵向微凹。唇、舌面都有纵沟从叶片间的缺口伸达齿冠基部。外唇棱中部膨大凸突。外舌棱上也有小的疣状隆起。

I_2 的基本形态与 I_1 的相似，也呈匍匐状向前伸，但较 I_1 稍小。顶端至少由四个疣状尖组成。最内侧的疣可能最高大，可惜已破损。从内往外疣依次稍变小。外唇棱上的肿疣也很明显，其顶端已磨蚀变平。

I_3 缺失。其齿槽的形状和直径都与 I_2 的相近，也向后下方斜伸。

C_1 呈斧形，明显向前匍匐。主尖位于齿的最前端。前侧棱坡陡，短而圆凸，似形成斧

的尖刃。后侧棱较长而坡缓，微凹，基部具小尖。在其舌侧还有一小尖与其相对。牙齿的唇面圆凸，舌面横向稍凸，纵向凹入。单齿根，位于齿的后部，齿冠前部则悬在 I_3 齿槽的上方。

C_1 与 P_4 间有三个齿槽，均约呈圆形，直径从前往后增大。第一齿槽位置稍靠外，后两齿槽纵向排列在中轴线上。它们可能分属三个均具单齿根的前臼齿：P_1，P_2 和 P_3；也可能是 P_1 已消失了，第一个齿槽则是 P_2 的，后两齿槽则均是 P_3 的。即 P_3 具两齿根。从该下颌骨前面的牙齿趋于向前压紧靠拢，鼩鼱类臼前齿趋于退化变少的特点看，后一种可能性大。

P_4 呈三角形。三角座为单尖，呈三角锥状。前棱较陡稍圆凸。后唇稍凹入，伸达齿的后外基部。后舌棱较陡直，下部有疣状隆起。舌面和唇面圆凸。后面稍凹，有一纵棱从齿尖顶伸达基部。跟座很宽短，横脊状。仅前齿带发育。

M_1 约呈前端尖突的三角形。三角座窄。下原尖呈高大的三角锥状。下前脊直，舌端与下后尖和下内尖在同一直线上，无明显的下前边尖。下后尖比下原尖小，但比下前脊高，与下原尖以 V 形谷分开，无下后脊。跟座明显宽于三角座。下内尖约与下后尖高度相近，但横向稍压扁。有弱的下内尖棱与下后尖相连。下次尖比下内尖稍大稍低。下斜脊向前伸达下原尖后方。下次凹浅。下后边脊低。下次小尖明显，位于齿的纵轴处。前齿带发育。后齿带从下次小尖伸达齿的后外基部。

下颌骨在 M_1 与上升支之间破损。从围岩上保存的印痕看，M_2 较 M_1 宽短。三角座与跟座都很发达，两者宽度相近。根据 M_2 的形态特征和 M_2 与下颌上升支之间的间隙看，可能有 M_3 存在。

表 3　吉林蓄鼩（新属、新种）*Ernosorex jilinensis* gen. et sp. nov. 正型标本 (holotype)：V 8796 测量（单位：毫米）

		I_2	I_3	C_1	P_4	M_1
下颌高 (H. of l. jaw)					2.72	2.72
长 (L)		1.04	0.80	1.60	1.60	2.08
宽 (W)	三角座 (trid.)	0.80	0.88	0.80	1.28	1.44
	跟　座 (tad.)					1.60

讨论　1. 关于 *Ernosorex* 的分类位置

Ernosorex 的下颌和牙齿的形态很特别，它混有刺猬科 Erinaceidae，近鼩鼱科 Plesiosoricidae 和鼩鼱科 Soricidae 的特点。一方面它具有此三科共有的特点，如下颌骨具两颏孔，冠状突前缘较陡，臼齿从前往后变小，M_1 下前脊发育，伸达牙齿的前舌端，三角座相对伸长等。另一方面，*Ernosorex* 还具有这些科的各自的一些特点：(1) 下颌前部不特别缩短，M_1 具下次小尖的特点与某些 plesiosoricids 和 erinaceids 的相似，与

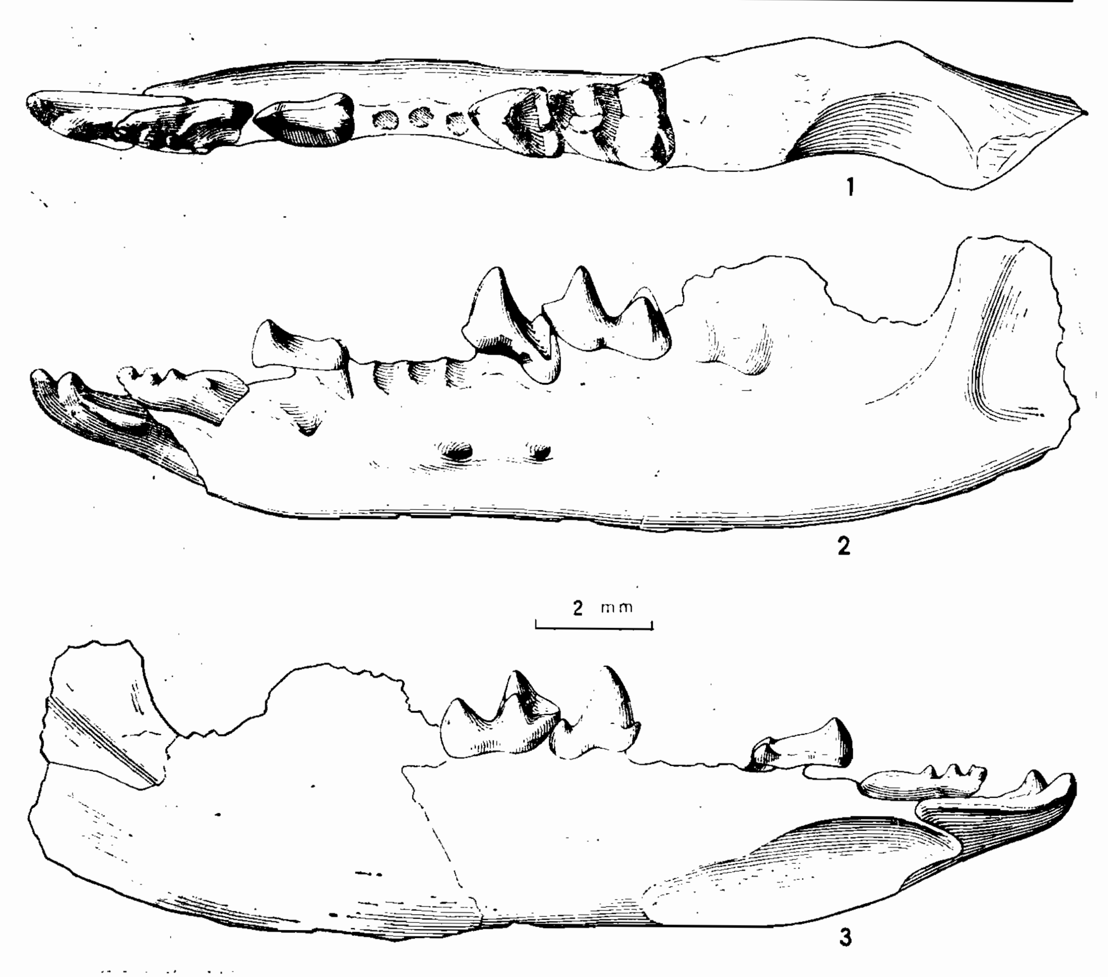


图7 *Ernosorex jilinensis* gen. et sp. nov. 正型标本 (holotype) 左下颌骨具 I_{1-2}, C_1 和 P_4-M_1 (left lower jaw with I_{1-2}, C_1 and P_4-M_1) V8796. 1. 嚼面观 (occlusal view); 2. 唇面观 (labial view), 3. 舌面观 (lingual view)

Soricidae 的不同；(2) M_1 的后齿带从下次小尖斜向外下方伸的特点则与 Erinaceidae 和某些 soricids 的相似；(3) 门齿增大,向前匍匐,臼前齿向前倾,彼此呈覆瓦状排列的特点则与 Plesiosoricidae 和 Soricidae 的相似；(4) P_4 非臼齿化，三角座为单尖，呈三角锥形，M_1 三角座明显窄于跟座，下内尖横扁，有下内尖棱与下后尖相连的特点则是 Soricidae 的典型特征。

综合分析一下 *Ernosorex* 与上述各科相似特征的性质，我们发现(1)项所列的特点都是原始特征。也就是说，*Ernosorex* 与 Erinaceidae 和 Plesiosoricidae 相似，而与 Soricidae 不同的特征是一些近祖性状，而不是近裔性状。*Ernosorex* 与 Erinaceidae 共有的 M_1 后齿带的特点虽是 Erinaceidae 科的典型特点之一，但并不是它的排它性特点。某些 soricids，如 *Nectagale* 等属也具有这一特点。(3)项中列举的都是特化特征。这表明 *Ernosorex* 与 Erinaceidae 不同,而与 Plesiosoricidae 和 Soricidae 相似的特征都是获得性特征。特别需要指出的是 P_4 的形态和 M_1 下内尖的形态都是 Soricidae 的典型

特征，而 *Ernosorex* 却具有 Soricidae 的这些典型特征，并以这些特征与 Erinaceidae 和 Plesiosoricidae 相区别。显然(4)项中所列举的特点正是 *Ernosorex* 与 Soricidae 的近裔共性。

由前面的比较和分析可以看出，*Ernosorex* 与 Soricidae 的关系最近。它们的近裔共性是：P_4 非臼齿化，三角座呈简单的三角锥状，M_1 下内尖横扁，前端与下后尖相连等。然后，它们又以门齿增大，向前匍匐，臼前齿前倾，呈覆瓦状排列等近裔共性与 Plesiosoricidae 组成姐妹组。这样，这三科中以 Erinaceidae 与 *Ernosorex* 的关系最远。

2. 关于鼩鼱科的起源

在已知较原始的食虫类中，与 Soricidae 最接近的是欧洲晚始新世的 *Saturninia*。Stehlin (1940, P. 306) 在研究 *Saturninia* 时，曾将它归入 Soricidae，并认为虽然它的许多特点介于鼩鼱和一般食虫类之间，但它并不是现生鼩鼱的直接祖先。Wilson (1960) 和 Repenning (1960, P. 4) 也有同样的看法。而且 Repenning (1960, P. 58) 还明确指出："现已知的鼩鼱的形态都不够一般化，不能作为鼩鼱类的共同祖先。"他根据 Soricidae 科已知最老成员的形态特点，以及这些特点在后期成员中表现出的变化趋势，推论出鼩鼱类原始祖先的特点。我们将 *Ernosorex* 与 Repenning 的假设的原始祖先的特点进行比较后发现，它们的基本特点是一致的。只是 *Ernosorex* 还具有一些更原始的特点(如 M_1 具下次小尖等)，同时还缺少一些 Soricidae 的特化特征。很可能 *Ernosorex* 正好代表 Soricidae 的原始类型。因此，将 *Ernosorex* 作为一种最原始的鼩鼱而归入 Soricidae 似乎更合适些。

鼩鼱科已知最早出现于北美尤因他晚期，在欧洲和亚洲则是从中渐新世才开始出现。如果 *Ernosorex* 代表鼩鼱类的原始类型的分析是合理的话，这不但把鼩鼱科在亚洲出现的时间大大往前推了，说明鼩鼱科可能在始新世时就已在亚洲出现了，而且表明鼩鼱科有可能是由亚洲起源，然后迁往北美和欧洲的。需要指出的是 *Ernosorex* 本身出现的时代较晚，不可能成为鼩鼱科的真正祖先，而可能代表保持有原始特征的旁枝。

灵长目 Primates Linnaeus, 1758

始镜猴科 Omomyidae Trouessart, 1879

始镜猴亚科 Omomyinae Trouessart, 1879

长白亚洲镜猴(新属、新种) *Asiomomys changbaicus* gen. et sp. nov.

(图 8；图版 III，3a，3b，4)

正型标本　右下颌骨具 P_3，M_2 和 M_3 (V 8802)。

地点和层位　公郎头油母页岩矿(85006)；桦甸组第 III 岩性段。

特征　尺寸和形态与 *Omomys powayensis* 相近；P_3 单尖，二齿根；M_{2-3} 齿冠很低，尖和脊都很低缓，三角座很低，前后特别短，三角座盆很狭小，下前尖发达，位于齿前缘中部；下后脊不完全；跟座盆开阔，非常浅；下次小尖小，前后压缩；下斜脊靠近唇侧缘，下次凹很浅。

名称来源　Asiomomys = Asia + Omomys 亚洲+始镜猴；Changbai，长白，化石

地点附近的山脉名称。

描述 下颌(图 8)骨水平支下缘平直。颏孔位于 P_4 下方。冠状突前缘与水平支齿槽缘的夹角约 60°。咬肌窝前端伸达 M_3 后下方。下颌骨向后下方伸。

P_3 三角座为单尖，三角锥状。顶端破损。前棱较尖锐，后唇棱弱。后舌棱仅在下部发育。跟座为横脊形，与主尖后唇棱相交处形成一尖。具二齿根。

M_2 约呈梯形，前缘稍短于后缘。齿冠很低。三角座特别低，前后强烈压缩变短，三主尖均呈低矮的丘形。下前尖很发达，位于牙齿前缘中部，正好与下原尖和下后尖间的缺口相对。与下后尖以沟分开，与下原尖有低缓的下前脊相连。下后尖呈开阔的 V 形，其前臂与下后脊约呈直角相交。下后脊低缓，中间中断。三角座盆很窄小而浅，稍向后倾，后端开口。跟座仅比三角座稍低。下次尖为牙齿中最大的尖。斜脊主要向前伸达下原尖后下方。下次凹很浅。下内尖也很发达，但较下次尖稍低。具小的下前内尖。下前内尖棱和下后尖后棱都明显，但不相连。下后边脊呈后凸的弧形，很低缓，磨蚀后呈凹槽，中部稍膨大，可能为下次小尖受磨蚀的结果。下跟座盆开阔而浅，内侧开口为 V 形。珐琅质轻微褶皱。无内齿带。外齿带发育，后齿带只在牙齿后缘外侧发育。

M_3 比 M_2 长而稍窄。 三角座比 M_2 的更低、更短。主尖和脊也更低缓些。下前尖孤立，不与下前脊相连。在下前尖和下后尖前臂之间有一孤立的附加尖。下三角座盆更浅，后侧的开口更开阔。跟座与三角座间的高差更小。下次尖较低，横向压扁，沿齿的唇缘前后伸长。下内尖也很低缓。下次小尖很大，为 M_3 中最大的尖，经磨蚀后呈新月形凹槽。下斜脊沿齿的外缘伸达下原尖。下次凹很浅。跟座盆更大而开阔，很浅。其内侧开口呈开阔的 V 形。珐琅质褶皱也较明显。齿带只在齿的前外缘发育。

表 4 长白亚洲镜猴(新属、新种) *Asiomomys changbaicus* gen. et sp. nov. 正型标本 (holotype: V 8802)测量 (单位: 毫米)

		P_3-M_3	M_2-M_3	P_3	M_2	M_3
下颌高 (H. of l. jaw)				4.80	4.64	4.80
长 (L)		12.6	5.92	2.24	2.72	3.20
宽 (W)	三角座 (trid.)			1.72	2.16	2.05
	跟座 (tad.)				2.24	2.05

比较与讨论 *Asiomomys* 的下臼齿齿冠较低，三角座的尖的基部不膨大，下内尖和下次尖较扁平，靠近齿边缘，斜脊较靠近唇侧，以及前后明显伸长的特点都与 Omomyinae 的一致。在 Omomyinae 中与 *Asiomomys* 较相似的都是始新世中一晚期的属种，如 *Omomys*(勃力吉期—尤因他期)，*Utahia* (尤因他期)，*Chunashius* (杜契乃期) 和 *Dyseolemur* (尤因他期)等。

Asiomomys 在颊齿的尺寸、齿冠都很低，M_{2-3} 的三角座很短，下前尖位于齿冠前缘中部，斜脊几乎沿齿的唇缘延伸，下次凹浅，下次小尖在 M_2 小，相当长等特点与 *Omomys*

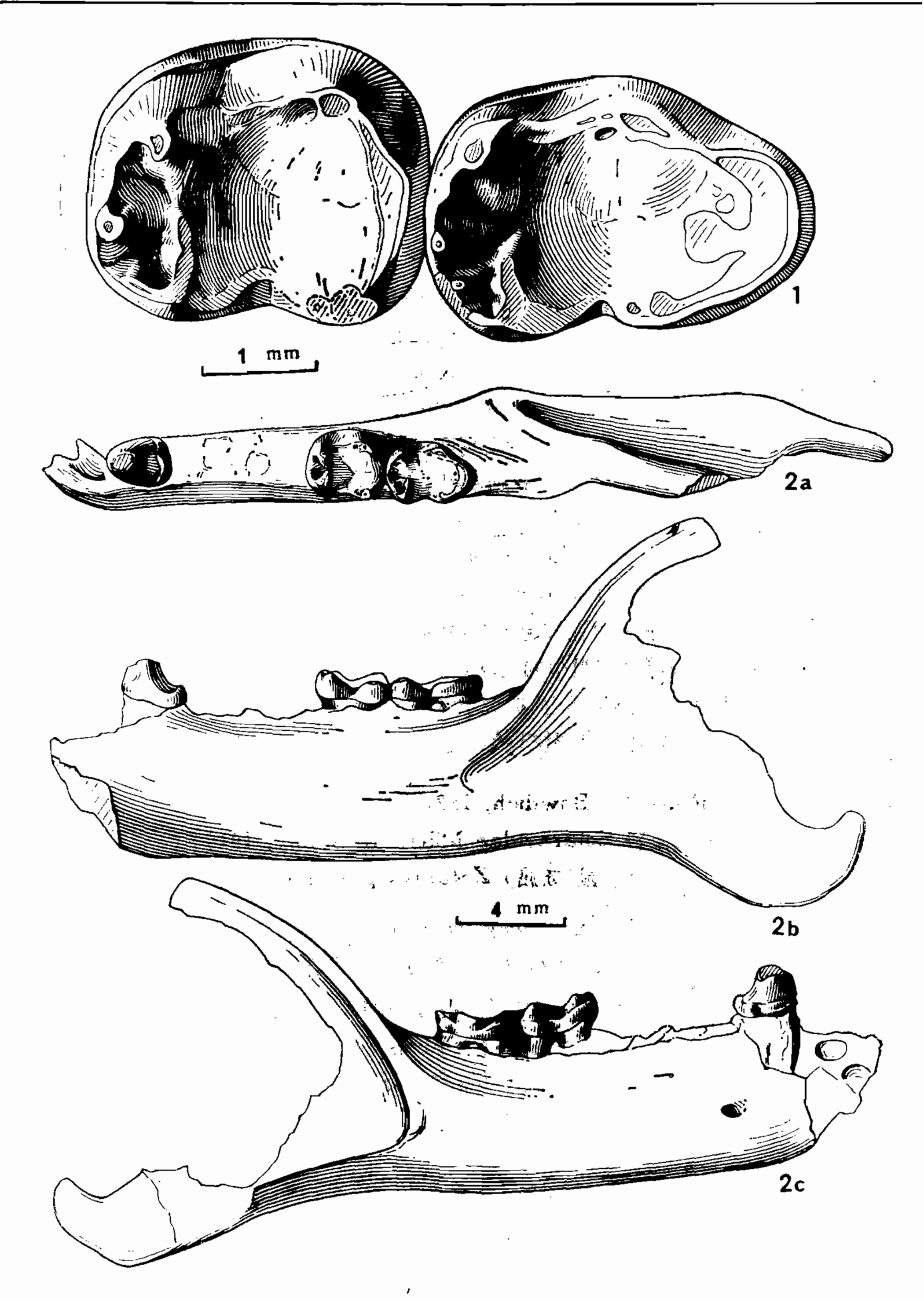


图 8 *Asiomomys changbaicus* gen. et sp. nov. 正型标本 (holotype) 右下颌骨具 P_3 和 M_{2-3}(right lower jaw with P_3 and M_{2-3}), V 8802　1. M_{2-3} 嚼面观(occlusal view); 2.下颌骨 (lower jaw)　2a. 嚼面观 (occlusal view), 2b. 舌面观 (lingual view), 2c. 唇面观 (labial view)

powayensis 的很相似,所不同的是 *Asiomomys* 的跟座盆较浅,三角座更低，与跟座高差更小，尖和脊都很低缓等。*Asiomomys* 与 *Omomys* 其他种的区别还在于臼齿的三角座很短,下前尖位于牙齿前缘中部等。与 *Utahia* 的区别是 *Asiomomys* 三角座很低，下前尖不退化,M_2 三角座很短,下斜脊靠近唇侧,下次凹很浅等。*Asiomomys* 与 *Chumashius* 的不同在于三角座短得多,下前尖发达,跟座盆较长,下次凹很浅等。*Asiomomys* 在下臼齿较窄长,三角座与跟座间的高差较小，跟座盆较长，下次凹较浅和 M_3 不退化等特点上明显与 *Dyseolemur* 不同。

从上面的比较可以看出，*Asiomomys* 在颊齿尺寸及其他形态特征上与 *Omomys powayensis* 最为相似，但 *Asiomomys* 不同于 *Omomys powayensis* 的特征为比较进步的特征。*Asiomomys* 很可能代表较 *Omomys powayensis* 稍进步的类型。

始镜猴科化石过去主要发现于欧洲和北美的始新统和渐新统。而始镜猴亚科则被认为是只限在北美繁盛的一类。近几年的发现和研究表明，亚洲始新世时也曾有始镜猴科的成员生活过，如我国山西垣曲中—晚始新世的黄河猴 *Huanghonius*，蒙古人民共和国早始新世的 *Altanius* 和巴基斯坦早—中始新世的 *Kohatius* 等。最近,扎莱和李(1986)论证了我国安徽早—中古新世的 *Decoredon*[1] 是灵长类，可能代表 Omomyidae 的一新分支。这是目前已知最早的 Omomyidae 的成员。因此他们认为真灵长类 (Euprimate) 不是从非洲起源的,而可能是由亚洲起源的,然后迁到欧洲和北美，而在亚洲却很快地绝灭了。*Asiomomys* 在我国桦甸组中的发现,不但证明 Omomyinae 的分布不再只限于北美,而是在始新世时也在亚洲生活过,扩大了 Omomyinae 的分布范围，而且给我们以启示：始镜猴科在亚洲可能并没有很快地绝灭。

啮齿目 Rodentia Bowdich, 1821
先松鼠科 Sciuravidae Miller et Gidley, 1918
争胜鼠(新属) *Zelomys* gen. nov.

属型种　东方争胜鼠(新种) *Zelomys orientalis* sp. nov.。

属的特征　身材与 *Sciuravus bridgeri* 相近。始啮型头骨，松鼠型下颌骨，颏孔位于 P_4 前下方;齿式 $\overline{1\ 0\ 1\ 3}$；颊齿从 P_4 往 M_3 逐渐增大。低冠，齿尖和齿脊明显但较纤细;具下前边尖,下中附尖明显,下外脊完全;下臼齿下原尖前臂伸达前齿带；下后脊 I 与前齿带或下原尖前臂相连;下后脊 II 在 M_{1-2} 很长,通常与下后尖相连；而在 M_3 较短，不与下后尖相连;下中脊短,下次脊发达,横向伸达下次尖前臂;下次小尖明显；下前齿带很发达。颊齿具珐琅质褶皱。

名称来源　Zelos,"希",争胜,热心。感谢吉林省地矿所的地质学家们，这是他们奋发努力的结果。

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1) 扎莱和李 (1986) 认为 *Diacronus anhuiensis* 应归入 *Decoredon* 属，与 *Decoredon elongatus* 是同一种。并认为 *D. anhuiensis* 是有效种。但是,因为 *Decoredon* 的模式种为 *D. elongatus* Xu, 1977, 那么，*D. elongatus* 应为有效种,而 *D.* anhuiensis 只是 *D. elongatus* 的同物异名,应被取消。

东方争胜鼠（新种）*Zelomys orientalis* sp. nov.

（图 9-2，图 10-3、4，图 11；图版 IV，3a、3b、5、6a、6b）

正型标本　左下颌骨具 I_1 和 P_4-M_3（V8797）。

归人标本　左下颌骨具 M_1-M_3（V8798）和部分头骨（V8799）。

产地和层位　公郎头油母页岩矿（85006：V8797）和公吉屯大勃吉公社油母页岩矿（85007：V8798 和 V8799）；桦甸组第 III 岩性段。

种的特征　下颌骨较粗壮，水平支较高；齿缺较短；下门齿粗壮，弯曲度大；P_4 下原尖近丘形，无明显的下后脊 II，下次脊向后斜，与下次小尖相连，下后凹很浅小。

名称来源　Orientalis，"拉"，东方的。

描述　下颌骨（图 9-2）较粗壮。齿间隙短。颏孔位于 P_4 前下方。咬肌窝前缘达 M_2 的下方。下颌角从门齿齿槽下方伸出，为松鼠型下颌骨。

齿式 $\overline{1\ 0\ 1\ 3}$（图 10-3、4）。颊齿从 P_4 到 M_3 逐渐增大，齿冠低，齿尖和齿脊均较明显。

I_1 粗壮，弯曲度大，切面呈横向压扁的椭圆形。珐琅质表面有纵向树枝状皱纹。

P_4 前窄后宽。三角座很小，高于跟座。下原尖和下后尖尺寸相近，均为丘形。无下后脊 II。下前边尖明显，在基部与下原尖相连。下三角盆非常狭小，前、后均开口。跟座较宽，下内尖和下次尖的尺寸和形状相近。下外脊完全，但较低。有下中尖，但无下中脊。下中附尖明显。下次脊不是横向的，而是斜向后外方伸达下次小尖。下次小尖发达。下后边脊很短，不与下内尖相连。下后凹很短浅。

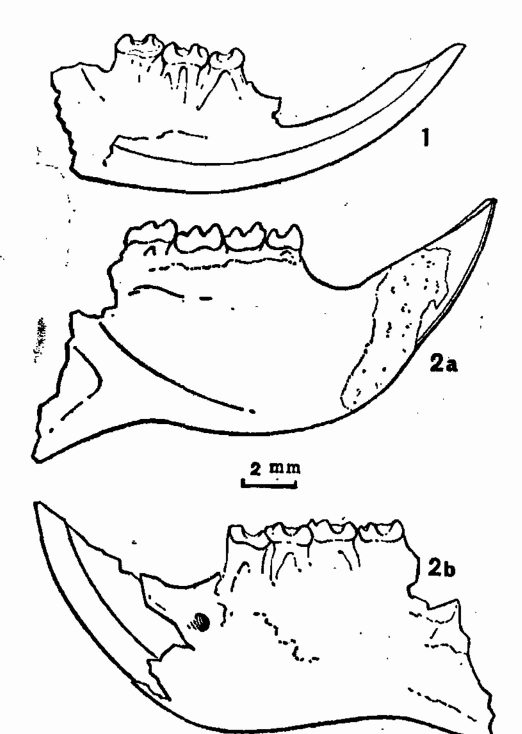


图 9　*Zelomys* gen. nov. 下颌骨（lower jaws）
1. *Z. gracilis* sp. nov. 正型标本（holotype）：右下颌骨具 I_1 和 P_4-M_2（right lower jaw with I_1 and P_4-M_2）V8800 唇面观（labial view）；2. *Z. orientalis* sp. nov. 正型标本（holotype）：左下颌骨具 I_1 和 P_4-M_3（left lower jaw with I_1 and P_4-M_3）V8799. 2a. 舌面观（lingual view），2b. 唇面观（labial view）

M_1 约呈前端稍窄的长方形。三角座窄小，与跟座高差不明显。下后尖与下内尖比下原尖和下次尖稍高。下后脊 I 发达，唇端与下原尖前臂相连，下后脊 II 较长，伸达下后尖，封闭三角座盆。下前边尖很发达，与下原尖相连。前齿带舌部很发达，水平地伸达下后尖的前方；唇部较弱，迅速向唇下方斜。下前凹浅，横向伸长。下原凹浅。下跟座宽而开阔，下次脊发达，横向伸达下次尖前臂。下外脊低，与下次尖相连（V8797）或有沟分开（V8798）。下中尖

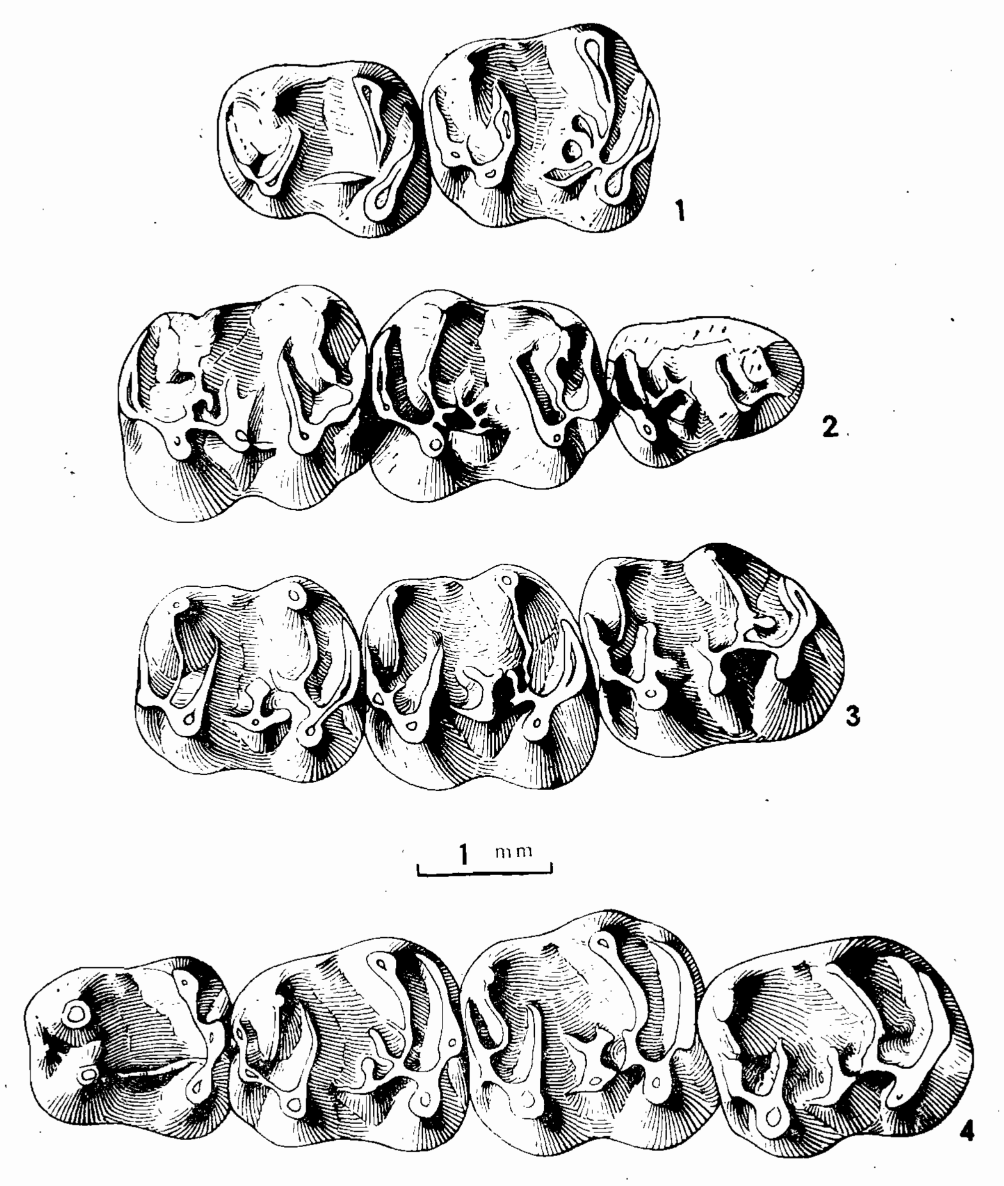


图 10 *Zelomys* gen. nov. 颊齿 (cheek teeth) 嚼面观 (occlusal view) 1—2. *Z. gracilis* sp. nov. 1. 左 (left) P_4-M_1 (V8801); 2. 正型标本 (holotype): 右 (right) P_4-M_2 (V8800); 3—4. *Z. orientalis* sp. nov. 3. 左 (left) M_1-M_3, V8798; 4. 正型标本 (holotype): 左 (left) P_4-M_3, V8797

发育具短的下中脊。下中附尖明显。下次小尖发达。下后边脊伸达下内尖后基部。下后凹横向伸长。牙面具不规则的珐琅质褶皱。

M_2 比 M_1 比例上较宽。下三角座更短。 下后脊 I 唇端向前伸达前齿带。下前凹浅，横向较短。下原凹较深。下中脊明显分叉。前齿带唇部更发达些。

M_3 比 M_2 较长。下后脊 I 较短，与前齿带的连接点内移。下前凹非常小，几乎消失。

下后脊 II 短，不与下后尖相连。三角座盆向后开口。下中尖很发达。下中脊不分叉。下后边脊不伸达下内尖。下后凹向内开口。牙面珐琅质褶皱较明显，下后凹被纵棱分割。

受挤压变扁的头骨（V8799，图 11）虽未保存颊齿，但其尺寸，门齿的形态、珐琅质结构都与上述下颌骨的相符合。可能它代表这个种的上颌骨。它的颧弓前基部咬肌附着的痕迹很明显。眶下孔小。为始啮型头骨。上门齿横切面约呈卵圆形。唇面稍圆凸。珐琅质表面具不规则的纵回纹饰。

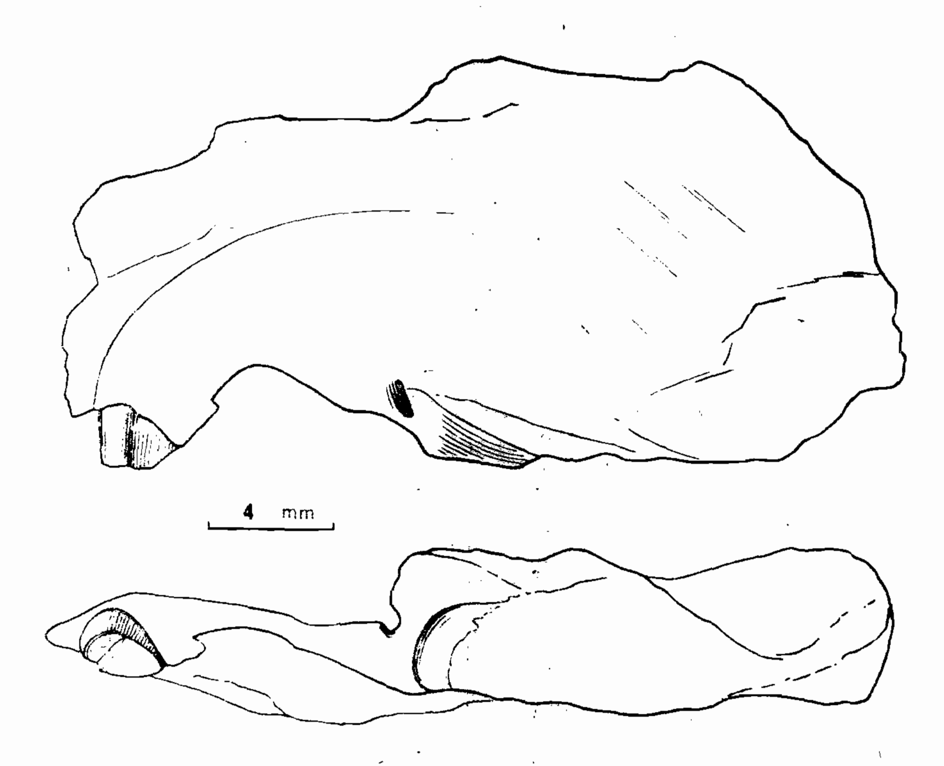


图 11 *Zelomys orientalis* gen. et sp. nov. 头骨 (skull), V8799. 上 (upper)：侧面观 (lateral view)，下 (Lower)：腹面观 (ventral view)

纤细争胜鼠（新种）*Zelomys gracilis* sp. nov.

（图 9-1，图 10-1、2；图版 IV，1a、1b、2a、2b、4）

正型标本　右下颌骨具 I_1，P_4-M_2（V8800）。

副型标本　左下颌骨具 P_4-M_1（V8801）。

产地和层位　公郎头油母页岩矿(85006)；桦甸组第 III 岩性段。

特征　下颌骨较纤细，齿间隙较长，下门齿纤细，弯曲度较小；颊齿不很粗壮，P_4 下原尖 V 形，下后尖较高大，下后脊 II 较发达；下次脊横向与下次尖前臂相连；M_2 下中脊不分叉。

名称来源　gracilis，"拉"，细的，瘦的。寓意其下颌和门齿都较纤细。

描述与比较　*Zelomys gracilis* 的颊齿尺寸与 *Z. orientalis* 的相近，但下颌骨比后者的纤细得多（图 9-1），其下颌骨高仅约为后者的 2/3。齿缺较长。下门齿较纤细，弯

曲度较小。P_4 下三角座高，下后尖高于下原尖。下原尖呈 V 形，下原尖后臂长，伸达下后尖，下原尖前臂与下前边尖相连。下前边尖较高，仅稍低于下原尖。下三角座盆较开阔。下中尖较明显。下外脊完全。下次脊横向延伸，与下次尖前臂相连。M_1-M_2 的下前边尖很发育，未完全融合到前齿带中。牙面珐琅质褶皱显著。M_2 下中脊不分叉(图 10-1、2)。

表 5 争胜鼠(新属) *Zelomys* gen. nov. 下颌测量(单位：毫米)

			Z. orientalis		*Z. gracilis*	
			V 8797 (holotype)	V 8798	V 8800 (holotype)	V8801
P_4-M_3 长 (L)			6.48			
M_1-M_3 长 (L)			5.08	5.25		
P_4	长 (L)		1.39		1.39	1.37
	宽 (W)	三角座 (trid)	1.07			1.07
		跟座 (tad)	1.23			1.28
M_1	长 (L)		1.64	1.64	1.64	1.64
	宽 (W)	三角座 (trid)	1.31	1.39	1.31	1.31
		跟座 (tad)	1.48	1.56	1.48	1.48
M_2	长 (L)		1.72	1.72	1.72	
	宽 (W)	三角座 (trid)	1.48	1.64	1.52	
		跟座 (tad)	1.64	1.72	1.48	
M_3	长 (L)		1.72	1.97		
	三角座宽 (W. of trid)		1.48	1.64		
I_1	长 (L)		2.13		1.56	
	宽 (W)		1.23		0.98	
下颌骨高 (M_1 下方) (H. of l. jaw under M_1)			6.64	6.48	4.54	
齿缺长 (L. of diastema)			4.05		5.18	

讨论 关于 *Zelomys* 的分类位置。*Zelomys* 具始啮型头骨和松鼠型下颌骨，应归入始啮亚目。在该亚目中，*Zelomys* 的头骨和下颌骨的形态、齿式，以及颊齿为低冠的丘脊形齿，臼齿三角座不高于跟座，具发达的下前边尖，有下后脊 I 和下后脊 II 和下次小尖的特点都与先松鼠科 Sciuravidae 的相似。

在先松鼠科中，*Zelomys* 的下颊齿的下原尖具前臂和较长的后臂，具完全的下外脊，有下中脊，下次脊完全，并与下次尖前臂相连等特点与 *Sciuravus* 的较相似，而与 *Tillomys*, *Knightomys* 和 *Pauromys* 等的不同。但是，*Zelomys* 的颊齿齿尖和脊都比 *Sciuravus* 的纤细，下前齿带发达，横向伸长，下后脊 I 较发达，并与下前齿带或下原尖前臂相连，以及具珐琅质褶皱等特点都与 *Sciuravus* 的不同。*Zelomys* 的这些特点显得比已知的 Sciuravids 的进步。因此，*Zelomys* 很可能代表较进步的先松鼠类。

应该指出的是，*Zelomys* 在下颌骨和下颊齿的基本形态上，如下颌骨较高，齿缺短，颏孔的位置，以及颊齿齿冠低，P_4 具下前边尖，下臼齿具两条下后脊，前齿带发达并与下原尖前臂相连，下外脊完全，下中脊短等特点都与北美 Chadronian 期的 *Namatomys* 很相似。所不同的是 *Namatomys* 的个体较小，M_1-M_2 下次脊短，向后伸达下后边脊，M_3 退化变小，不具下次脊等。*Namatomys* 是 Black 于 1965 年确立的，并被归入了 Eomyidae 科。如果单纯根据下颌骨和下颊齿的特点的相似，*Zelomys* 似乎应和 *Namatomys* 一起归入 Eomyidae 科。但是，如果上面关于头骨和下颌骨均属 *Zelomys* 的分析是正确的话，*Zelomys* 的头骨为始啮型。显然，*Zelomys* 不可能归入 Eomyidae 科。这样，又提出了一个问题，即 *Namatomys* 是否是真正的 Eomyidae?

关于 *Namatomys* 的分类位置。早在 1965 年 Black (p. 39—40) 就指出过，*Namatomys* 在具两个下后脊的特点上与已知的 eomyids 的都不同，与它们不可能有任何较近的亲缘关系。Wood (1980, p. 36—40) 也同意 Black 的看法。可惜 *Namatomys* 目前仅已知下颌骨，而无头骨和上颊齿列的资料，确定它的分类位置的确有困难。但在下颌骨和下颊齿的形态结构等特点上，*Namatomys* 与 *Zelomys* 最相似，也与 sciuravids 的较相似。*Namatomys* 与 *Zelomys* 有可能属于同一大类。因此，*Namatomys* 也有属 Sciuravidae 科的可能性。如果今后有更多的材料证明 *Zelomys* 的头骨 (V8799) 与下颌骨不属同一类，或者发现其上颊齿的齿式或颊齿形态与 Sciuravidae 的不同，它们也有可能代表不同于 Sciuravidae 的另一科。

Sciuravidae 过去仅发现于北美始新统。在北美以外的地区，如欧亚等大陆，却完全缺失。过去虽曾报道过在亚洲发现过先松鼠科的化石，如 *Tamquammys* Shevyreva, 1971; *Saykanomys* Shevyreva, 1972; *Advenimus* Dawson, 1964; *Tsinlingomys* Li, 1963; ?*Sciuravus* sp. Li, 1963, *Terrarboreus* Shevyreva, 1971 和 *Petrokozlovia* Shevyreva, 1972 等。但是，实际上这些属都不是先松鼠类。Dawson (1977), Wood (1977) 和 Dawson 等 (1984) 已先后将它们全部从先松鼠科中排出，而归入梳趾鼠超科 Ctenodactyloidea。这似乎意味着在亚洲没有先松鼠类生存过。如果上述关于 *Zelomys* 应归入 Sciuravidae 的分析是正确的话，这就表明了在亚洲的确有先松鼠科的动物生活过。它们有可能是由北美迁到亚洲来的。

四、桦甸哺乳动物群有关问题的探讨

1. 关于桦甸哺乳动物群的时代

关于桦甸盆地下第三系的研究已有半个多世纪了。该盆地的油页岩早在 1937 年以前就已被人发现了。1940 年西田彰一首次赴该地进行地质调查，认为产油页岩地层的时代为侏罗—白垩纪。不久，皆川信弥(1943)根据油页岩层中所产植物化石 *Fagus* sp. 和 *Quercus* sp. 确定其时代为老第三纪。稍后，铃木好一(1946)根据腹足类扁卷螺化石(*Planorbis pseudammonius*) 确定含油页岩地层时代为始新世。1949 年以后，我国地质工作者在该地区进行了大量的地质地层工作，但对这一套含油页岩地层的时代未作进一步详细的研究。1985 年，周家健和孙嘉儒根据油页岩层中所产的鱼化石初步确定其时代为早

始新世。

现在我们根据油页岩层中所含哺乳动物群来分析桦甸组的时代。

关于啮齿类。桦甸组中的啮齿类为先松鼠科的一新属 *Zelomys* 的二个新种。先松鼠科的化石过去仅在北美下一中始新统中发现过。它们最后出现于晚中始新世的尤因他早期，以后则完全绝灭了。由前面的比较可以看出，一方面 *Zelomys* 在牙齿的形态结构上比过去已知的先松鼠类要进步些；另一方面，它又在 M_3 不退化等特点上显得比 Chadronian 期的 *Namatomys* 原始。其时代可能晚于 Uintan 早期，早于 Chadronian 期。

灵长类与啮齿类有类似的情况。*Asiomomys* 与北美尤因他早期的 *Omomys powayensis* 最为相似，但它的某些特点又显得比后者的进步。从它的进步程度看，*Asiomomys* 的时代最早可能与 *O. powayensis* 的时代(尤因他早期)相当，但也可能稍晚，但似乎不会早于尤因他期。

在食虫类化石中，*Eochenus* 代表目前已知最原始的盔猬类。它不但比亚洲中渐新世的 *Tupaiodon* 和欧洲已知最早的盔猬类 *Tetracus* (早一中渐新世) 都原始，而且也比我国河堤组寨里段(晚中一晚始新世)的 *Ictopidium lechei* 还原始。可能 *Eochenus* 生活的时代更早些。

Tupaiodon 过去仅发现于中渐新段。而 *Tupaiodon huadianensis* 比已知的中渐新世的两个种: *T. morrisi* 和? *T. minutus* 要原始，它生活的时代也可能要早些。

典型的鼩鼱类最早已知出现在北美尤因他晚期，而且从那时开始，鼩鼱科就开始了明显的分化。*Ernosorex* 显然比目前已知的鼩鼱类都原始，可能代表鼩鼱类的一支较原始的旁支。很可能它出现的时代也较早。

综上所述，桦甸哺乳动物群的时代可能在尤因他期到早渐新世这一段时间内，很可能与尤因他晚期相当，也可能为晚始新世。

2. 桦甸哺乳动物群与其他地区哺乳动物群的关系

将桦甸哺乳动物群与亚洲目前已知的始新世动物群比较，我们发现，除了寨里段中的 *Ictopidium lechei* 有可能是 *Tupaiodon* 外，其他各类还没有相同的属种存在。桦甸哺乳动物群与亚洲其他地区同时期的动物群的这些差别很可能与收集不全和埋藏条件有关。因为桦甸哺乳动物群的种类和数量毕竟是太少了。此外，这次发现的桦甸哺乳动物群是以小哺乳动物为主，而在其他地区小哺乳动物发现得还很少。另一方面也可能和当时的生态环境有关。当时中亚和东亚广大地区可能为较开阔的平原和湖泊景观。而桦甸地区当时可能为森林沼泽和湖泊景观。因此，在不同的生态环境里，就有可能生活着不同类型的动物。在亚洲其他地区是以奇蹄类等大型哺乳动物为主，而桦甸则出现了先松鼠、灵长类等森林类型。因此，要真正了解桦甸动物群与亚洲其他地区动物群的关系，还需要收集更多的资料。

在桦甸哺乳动物群中，Sciuravidae 和 Omomyinae 只在北美发现过。尽管在桦甸动物群中未发现与北美相同的属种，但桦甸的种类与北美的很相似是显而易见的。相反地，这两类却从未在欧洲和其他地区发现过。这至少表明，在当时亚洲与北美之间存在动物群交流。而与欧洲之间并不存在交流。因此，北美与亚洲之间的交流在当时很可能是

直接进行的，而不需要借道欧洲。

桦甸的食虫类的情况似乎与上述两类的有所不同。因为刺猬科盔猬亚科的化石过去只在亚洲和欧洲下第三系中发现过，而在北美最早的代表则发现于中新统。然而，它们在欧洲出现的时间要比桦甸的晚，而且种类也进步些。如果桦甸的 *Eochenus* 与欧洲的 *Tetracus* 等盔猬类可能有什么关系的话，欧洲的盔猬类很可能是从亚洲移过去的。但迁移的时间要晚些，可能是在“大间断”之后。也就是说，盔猬类是在土尔盖海峡消失后由亚洲迁往欧洲去的种类之一。

综上所述，桦甸哺乳动物群显示出它与北美的动物群的关系比较密切，彼此间有动物群的交流。其中先松鼠类可能是由北美迁到亚洲来的。至于灵长类，可能如扎莱和李传夔所指出的，是由亚洲迁往北美的，也可能相反。其迁徙方向有待发现更多的材料，做深入研究才能解决。

3. 桦甸盆地在始新世中晚期的古生态环境

桦甸哺乳动物群已知的种类很有限，要想对桦甸盆地中一晚始新世时的生态环境作全面的分析是有困难的。现在只是根据现有资料通过与现生动物生态的比较对它作一肤浅的分析。

桦甸哺乳动物群包括三个目。其中食虫目盔猬类的现生种类，如 *Echinosorex* 和 *Hylomys* 等都只生活在亚洲南部潮湿的森林地区。现生的鼩鼱类分布很广，遍布各大陆，但通常生活在潮湿地区。现生的 *Sorex* 则生活于古北区的森林地带。尽管始镜猴科已绝灭了，但现生的灵长类绝大多数都生活在热带、亚热带和温带的丛林中。现生的眼镜猴科（Tarsiidae）分布于东南亚，为热带、亚热带森林中的树栖动物。此外，与哺乳动物共生的动物还有大量的鱼类、属于涉禽的鹮科和游禽的鸭科化石，以及大量的腹足类等。这些动物都是生活在有大片水域的水中或水边的动物。此外，在岩层中还含有丰富的孢粉化石。其中多数属乔木，是温带一亚热带潮湿地区生长的类型。再加上该地层中还夹有大量的油页岩层和煤层。这些都表明桦甸盆地在中一晚始新世时，气候可能比较温暖潮湿，为森林沼泽湖泊景观。

五、结　论

1. 桦甸哺乳动物群是在我国东北地区发现的第一个早第三纪哺乳动物群。这一发现不仅为东北地区早第三纪哺乳动物群的研究打开了新的一页，也为我国始新世哺乳动物群增加了新的内容。该动物群的时代可能与北美尤因他晚期的时代相当，或较晚，为晚始新世。

2. 桦甸哺乳动物群以小型哺乳动物为主，主要生活在森林地区。桦甸盆地在中一晚始新世时可能为森林沼泽湖泊景观。气候较温暖潮湿。

3. 桦甸哺乳动物群与北美的动物群有较近的关系，而与欧洲的不同。这表明当时在亚洲和北美之间有直接的动物群交流。

4. 在我国有许多盆地产下第三系油页岩，并富产鱼化石（如三水盆地、茂名盆地等），

但却从未发现过哺乳动物化石。这次在桦甸盆地的油页岩中发现哺乳动物化石与鱼化石共生。这给我们今后工作以启示：注意在含油页岩和煤系地层中去寻找更多的哺乳动物化石。

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参 考 文 献

西田彰一，1940：吉林省桦甸附近に于ける油页岩の新产地(豫报)。伪满地质调查所报告，99号，27—31。

李传夔，1963：Paramyid 和 sciuravids 在中国的新发现。古脊椎动物与古人类，7(2)，151—160。

——，1975：河南、内蒙晚始新世啮齿类化石。古脊椎动物与古人类，13(1)，58—70。

张普林、吕宝臣、李春田、孙嘉儒、刘爱，1986：早第三纪桦甸动物群的发现及其地质意义。吉林地质，1986年4期，1—11。

周家健、孙嘉儒，1985：吉林省桦甸早始新世晚期鱼群。古脊椎动物学报，23(2)，p. 170。

皆川信弥，1943：吉林省桦甸附近に发达する含油母页岩层の时代に就いて。伪满地质协会志，4—5号，47--88。

铃木好一，1946：满州吉林桦甸及び蛟河のいわゆる中生层の时代について。地质学杂志，52，610—615号，65—66。

Black, C. C., 1965: Fossil mammals from Montana. Part 2. Rodents from the early Oligocene Pipestone Springs local fauna. *Ann. Carnegie Mus.*, 38(1), 1—48.

Butler, P. M., 1948: On the evolution of the skull and teeth in the Erinaceidae with species reference to fossil material in the British Museum. *Proc. Zool. Soc. London*, 118, 446—500.

——, 1956: Erinaceidae from the Miocene of East Africa. *Fossil Mammals of Africa*, 11, 1—75.

——, 1956: The skull of Ictops and the classification of the Insectivora. *Proc. Zool. Soc. London*, 126, 453—481.

——, 1972: The problem of insectivore classification. In: K. A. Joyesey & T. S. Kemp (eds.), Studies in Vertebrate evolution, New York, Winchester Press. 253—265.

——, 1978: Insectivora and Chiroptera. In: V. J. Maglio & H. B. S. Cooks (eds.), Evolution of African Mammals. Cambridge (Mass.) and London, Harvard University Press, 56—68.

Crochet, J. Y., 1974: Les Insectivores des Phosphorites du Quercy. *Palaeovertebrata*, 6, 109—159.

Dashezeveg, D. & M. C. McKenna, 1977: Tarsioid primate from the Early Tertiary of the Mongolian People's Republic. *Acta Palaeont. Polonica*, 22(2), 119—137.

Dawson, M., 1961: The skull of *Sciuravus nitidus*, A middle Eocene rodent. *Postilla Yale Peabody Mus. Nat. Hist.*, (53), 1—13.

——, 1964: Late Eocene rodents (Mammalia) from Inner Mongonia. *Amer. Mus. Novitates*, (2191), 1—15.

——, 1967: Middle Eocene rodents (Mammalia) from Northeastern Utah. *Ann. Carnegie Mus.*, 39, Art. 20, 327—370.

——, 1977: Late Eocene rodents radiations: North America, Europe and Asia. *Geobios, Mem. special*, (1), 195—210.

Dawson, M., Li, C. K. & Qi, T., 1984: Eocene Ctenodactyloid rodents (Mammalia) of Eastern and Central Asia. *Carnegie Mus. Nat. Hist., special Publ.*, (9), 138—150.

Engesser, B., 1972: Die obermiozane Saugetierfauna von Anwil (Baselland). *Tatigkeit. Naturforsch. Gesellsch. Baselland*, 28, 37—363.

Gazin, C. L., 1958: A review of the middle and upper Eocene Primates of North America. *Smithsonian Misc. Coll.*, 136 (1), 1—112.

——, 1961: New sciuravid rodents from the Lower Eocene Knight Formation of Western Wyoming. *Proc. Biol. Soc. Washington*, 74, Art. 21, 193—194.

——, 1962: A further study of the Lower Eocene Mammalian fauna of Southwestern Wyoming. *Smithsonian Misc. Coll.*, 144 (1), 1—98.

Gingerich, P. D., 1981: Early Cenozoic Omomyidae and the evolutionary history of Tarsiiform primates. *Journ. Human Evol.*, 10, 345—375.

——, 1984: Paleobiology of Tarsiiform primates. In: C. Niemitz (ed.), Biology of Tarsiers, Gustav Fischer, Stuttgart, 33—44.

Korth, W. W., 1984: Earliest Tertiary evolution and radiation of rodents in North America. *Bull. Carnegie*

Mus. Nat. Hist., (24), 1—71.

Krishtalka, L., 1976: Early Tertiary Adapisoricidae and Erinaceidae (Mammalia: Insectivora) of North America. *Bull. Carnegie Mus. Nat. Hist.*, 1, 1—40.

————, 1977: Eraly Eocene Euramerican Insectivora. *Geobios, Mem. special*, (1), 135—139.

Krishtalka, L., R. K. Stucky, R. M. West, M. C. McKenna, C. C. Black, T. M. Bown, M. R. Dawson, D. J. Golz, J. J. Flynn, J. A. Lillegraven & W. D. Turnbull, 1987: Eocene (Wasatchian through Duchesnean) Biochronology of North America. In: M. O. Woosburne (ed.), Cenozoic Mammals of North America., Univ. of California Press, Berkeley, Los Angeles and London, 77—117.

Krishtalka, L. & R. M., West, 1977: Paleontology and geology of the Bridger Formation, Southern Green River Basin Southwestern Wyoming. Part 2, The Bridgerian Insectivore, *Entomelestes grangeri*. *Contr. Biol. Geol.*, (14), 1—9.

Lavocat, R., 1951: Revision de la Fauna des Mammiferes Oligocene d'Auvergne et du Velay. *Sci. Avernir*, 1—153.

Lillegraven, J. A., 1980: Primates from Later Eocene Rocks of Southern California. *J. Mamm.*, **61** (2), 181—204.

McKenna, M. C., 1960: Fossil Mammalian of the early Wasatchian Four Mile fauna, Eocene of Northwest Colorado. *Univ. California Publ.*, *Geol. Sci.*, **37** (1), 1—130.

McKenna, M. C. & G. G. Simpson, 1959: A new insectivore from the middle Eocene of Tabernade Butte, Wyoming. *Amer. Mus. Novitates*, (1952), 1—12.

Matthew, W. D., 1909: The Carnivora and Insectivora of the Bridger Basin. *Mem. Amer. Mus. Nat. Hist.*, 9, 289—567.

Matthew, W. D. & W. Granger, 1924: New Insectivores and Ruminants from the Tertiary of Mongolia, with remarks on the correlation. *Amer. Mus. Novitates*, (105), 1—7.

Patterson, B. & P. O. McGrew, 1937: A Soricid and two erinaceids from the White River Oligocene. *Field Mus. Nat. Hist.*, *Geol.* Ser., 6, 245—272.

Repenning, C. A., 1967: Subfamilies and genera of the Soricidae. *Geol. Sur. Profes. Paper*, 565, 1—74.

Russell, D. E. & P. D. Gingerich, 1980: Un nouveau Primate omomyide dans l'Eocene du Pakistan. *C. R. Acad. Sci. Paris*, 291, Ser. D, 621—624.

Russell, D. E. & Zhai R. J., 1987: The Paleogene of Asia: mammals and stratigraphy. *Mem. Mus. Nat. Hist. Natur.*, *Sci. Terr.*, 52, 1—488.

Shevyreva, N. S., 1971: New rodents from the middle Oligocene of Kazakhstan and Mongolia. *Trans. Paleont. Inst. Acad. Sci. USSR*, 137, 70—86.

————, 1972: New Paleogene rodents from Mongolia and Kazakhstan. *Paleont. J.*, 3, 134—145.

————, 1976: Paleogene rodents of Asia. *Trans. Paleont. Inst. Acad. Sci. USSR*, 158, 1—111.

Stehlin, H. G., 1940: Zur Stammesgeschichte der Soriciden. *Ecl. Geol. Helv.*, 33(2), 298—306.

Sulimski, A., 1969: On some Oligocene insectivore remains from Mongolia. *Palaeont. Polonica*, 21, 53—72.

Szalay, F. S., 1976: Systematics of the Omomyidae (Tarsiiformes, Primates) taxonomys, phylogeny and adaptations. *Bull. Amer. Mus. Hist.*, 156, Art. 3, 157—450.

Szalay, F. S. & E. Delson, 1979: Evolutionary history of the primates. Acad. Press, 1—580.

Szalay, F. S. & Li, C. K., 1986: Middle Paleocene Euprimate from Southern China and the distribution of Primates in the Paleogene. *Jour. Human Evol.*, 15, 387—397.

Troxell, E. L., 1923: *Pauromys perditus*, a small rodent. *Amer. Jour. Sci.*, Ser. 5, 5, 155—156.

————, 1923: The Eocene rodents Sciuravus and Tillomys. *Amer. Jour. Sci.*, Ser., 5, 5, 283—296.

Van Valen, L., 1967: New Paleocene insectivores and insectivore classification. *Bull. Amer. Mus. Nat. Hist.*, 135, Art. 5, 217—284.

Viret, J., 1938: Etude sur quelques erinaceides fossiles specialement sur le genre *Paleronaceus*. *Travaux La. Geol. Fasc.* 34, Mem. 28, 1—32.

————, 1940: Etude sur quelques erinaceides fossiles genre *Plesiosorex*, *Lanthanotherium* (suite). *Travaux Lab. Geol. Fasc.* 39, Mem. 28, 33—65.

Wilson, R. W., 1938: Review of some rodent genera from Bridger Eocene, Part I. *Amer. Jour. Soc.*, 35, 123—137.

————, 1938: Review of some rodent genera from the Bridger Eocene. Part II. *Amer. Jour. Sci.*, 35, 207—222.

————, 1938: Review of some rodent genera from the Bridger Eocene. Part III. *Amer. Jour. Sci.*, 35, 297—304.

——————, 1940: Two new Eocene rodents from California. *Carnegie Inst. Washington, Publ.*, (514), 85—95.

——————, 1949: Early Tertiary rodents of North America. IV. *Carnegie Inst. Washington Publ.*, (584), 71—164.

——————, 1960: Early Miocene rodents and insectivore from Northeastern Colorado, *Univ. Kansas Paleont. Contr., Vertebrata*, 7, 1—92.

Wood, A. E., 1959: Rodentia. In R. O. McGrew (ed.), The geology and paleontology of the Elk Mountain and Tabernacle Butte area, Wyoming. *Bull. Amer. Mus. Nat. Hist.*, 117, 157—169.

——————, 1959: A new sciuravid rodent of the genus *Pauromys* from the Eocene of Wyoming. *Amer. Mus. Novitates*, (1978), 1—6.

——————, 1980: The Oligocene rodents of North America. *Trans. Amer. Philos. Soc.*, 70(5), 1—68.

Zdansky, O., 1930: Die alttertiaren Saugetiere Chinas nebst stratigraphischen Bemerkungen. *Palaeont. Sinica.*, Ser. C, 6, Fasc. 2, 1—87.

FIRST PALEOGENE MAMMALIAN FAUNA FROM NORTHEAST CHINA

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Key words Jilin; Paleogene; Insectivora; Primates; Rodentia

Summary

In Northeast China Paleogene oil shale and coal deposits have been extensively exploited in many basins for about a half century. However, no fossil mammals had ever been found until 1984 when a team of the Regional Geological Survey, Bureau of Geology and Mineral Resources of Jilin Province (RGSJ) discovered the first bones from Huadian Basin in the central part of Jilin Province. In the next year, 1985, a joint team of the RGSJ and the Institute of Vertebrate Paleontology and Paleoanthropology, Academia Sinica (IVPP) surveyed the site and found more fossils there. Together with mammalian fossils, fossil fish, reptiles, birds, gastropods and spore-pollen are abundantly collected as well.

The discovery of this mammalian fauna not only filled up the gap in the Paleogene mammal record in Northeast China, but also provided valuable information about its geological age, its relationship with faunas of the same age of other continents and the paleoclimate and paleoecology of Northeast China. Meanwhile, it also threw light on the origin and distribution pattern of some taxa.

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Systematics

Insectivora Cuvier, 1817

Erinaceidae Fisher von Waldheim, 1817

Galericinae Pomel, 1848

Eochenus sinensis gen. et sp. nov.

Holotype A left lower jaw with I/2-3, C/1 and P/2-M/3 (IVPP: V 8786).

Referred specimens 7 lower jaws (V 8787-V 8792, V 8794) and an upper jaw with C1/, P1/, P4/ and M2-3/(V 8793).

Locality and horizon IVPP Loc. 85007 (V 8786-V 8789), Daboji Oil Shale Mine, Gongjitun village, Loc. 85006 (V 8790-V 8793), Gonglangtou Oil Shale Mine and Loc. 85008 (V 8794), Cunjin, Huadian County, Jilin Province; Member III(V 8786-V 8793) and Member IV(V 8794) of Huadian Formation.

Diagnosis A primite galericine, close to *Tetracus* in size. lower jaw relatively thick with single mental foramen below P/2 or P/3; dental formula: ? 1 4 3/3 1 4 3; lower incisors bilobate, I/2 larger than I/3, cheek teeth thick, low-crowned, with blunt cusps; P/1 single-rooted, P/2-4 double-rooted, P/3 much smaller than P/4, P/4 has equally developed paraconid and metaconid and very short talonid; trigonid of lower molars short, with short straight paralophid extending more transversely and metaconid situated lingual to protoconid, hypoconulids increasingly distinct from M/1 to M/3; C1/-P3/ double-rooted, P4/ 3-rooted; M2/ wider than long with very developed protoconule and metaconule, small and coniform hypocone connected with postprotocrista and posterior cingulum by weak crests respectively; M3/ triangular with 5 cusps including developed protoconule and metaconule.

Etymology Eos, Greek, Dawn; Chenus, Greek, hedgehog. It means that the animal represents a primitive hedgehog.

Description The horizontal ramus of the mandible is relatively stout with a straight lower margin. There is usually a single mental foramen below P/3, but occasionally below P/2, except V 8791 which has 2 mental foramina below P/3 and P/2 respectively. The anterior edge of the coronoid process is straight and almost vertical. The condyle is slightly elevated in relation to the tooth row. The angular process extending backwards is slightly lower than the level of the tooth row. The mandibular foramen is at about the same level as the tooth row.

Dental formula: ? 1 4 3/3 1 4 3. I/1 is not preserved. I/2 is the largest of the incisors. Both I/2 and I/3 are bilobate: a large median one and a small lateral one.

P/1 is single-rooted. P/2 is laterally compressed coniform with small paraconid and low wide talonid cusp and 2 roots. No cingulum.

P/3 is wider than P/2 in proportion. Its main cusp is slightly stouter and more symmetrical with a distinct paraconid and more developed talonid assuming a form of transverse crest. There are developed and continued anterior, inner and posterior cingula, but no external cingulum.

P/4 is much larger than P/3. Its protoconid is robust and tall with its top slanting posteriorly. The metaconid is as large as the paraconid and placed lingually to the protoconid. The talonid is of transverse crest in form.

Lower molars decrease in size from M/1 to M/3, with blunt cusps.

M/1 is trapezoid in outline with a straight lingual margin. The trigonid is short, with a short and straight paralophid extending more transversely. The protoconid is the largest and tallest cusp. The metaconid is just lingual to the protoconid, from which it is separated by a V-shaped notch, rather than joined by metalophid. The talonid is shorter, wider and lower than the trigonid. The entoconid is opposite to the hypoconid at the posterior margin. No distinct hypoconulid can be seen. The broad talonid basin opens lingually. The anterior and external cingula are developed. Beginning at the middle of the posterolophid the posterior cingulum slopes down buccally behind the hypoconid.

M/2 is smaller than M/1. The paralophid is shorter and lower, with its lingual end curved posteriorly but without distinct anteroconid. The metaconid is close to the protoconid in size and shape. The trigonid basin is narrower and shallower. The talonid is broad with more or less distinct hypoconulid at the middle of the posterolophid.

M/3 is smaller than M/2 in size but longer in proportion. The hypoconulid is as developed as the entoconid, but variable in position. Sometimes it is very close to the entoconid to form twin cusps, but sometiomes it is close to the medial line and separated from the entoconid by a wide valley. Both the posterolophid and the posterior cingulum are less developed.

C1/ is coniform laterally compressed, with a small anterior cusp and a distinct posterior cusp and two roots.

P1/ is similar to C1/ in shape but smaller. P2/ and P3/ are two-rooted. On P4/ the paracone is high and coniform, with developed postparacrista joining the metacrista, together forming a shearing crest. The parastyle is connected with the anterior cingulum rather than the paracone. The external and posterior cingula are developed.

M2/ is wider than long. The paracone and metacone are about the same in size and shape, and located near the external margin, with straight preparacrista, low and straight centrocrista and long curved postmetacrista extending to the externo-posterior corner. The protocone has a long and tall preprotocrista reaching the protoconule and a short, low postprotocrista reaching the metaconule. The protoconule is smaller than metaconule. The preprotoconule crista is longer than the postprotoconule one and joins the anterior cingulum. The metaconule has short but distinct anterior crista and posterior crista. The hypocone is coniform and smaller than protocone and connected with the postprotocrista and posterior cingulum by weak crests resprectively. The external and posterior cingula are well developed, while the inner cingulum is quite weak.

M3/ is triangular in form with three roots. The metacone is situated at the postero-labial corner of the tooth. The metacrista, metastyle and hypocone all disappeared. However, the protoconule and metaconule are still developed. The posterior cingulum is very weak.

Comparison *Eochenus* agrees well with the Galericinae as far as its main features are concerned. *Eochenus* is similar to *Tupaiodon* but different from other genera of the Galericinae in having a shorter M/1 with shorter trigonid, more transverse paralophid and having distinct hypoconulid on M/3. On the other hand, in having proportionally narrower and longer upper molars, distinct protoconule, simple and much smaller P/3, less developed para-

conid and metaconid of P/4, lower trigonid with metaconid lingual to protoconid on lower molars and less developed paralophid on M/2-3, *Eochenus* is similar to *Tetracus* and *Galerix* rather than to *Tupaiodon*. Moreover, *Eochenus* differs from *Tupaiodon* in having lower crown, more robust cheek teeth and blunt cusps; from *Tetracus* and *Galerix* in the position of the mental foramen; from *Galerix* in having bilobate incisors, deeper hypoflexid of M/1, smaller hypocone of M2/, and 5 cusps including developed protoconule and metaconule on M3/.

It seems to us that all the features which are similar to *Tupaiodon* but differs from *Galerix* and *Tetracus* are primitive. In addition, *Eochenus*, like *Tetracus* and *Galerix*, lacks the specialized features of *Tupaiodon* in premolar structure and the position of metaconid of molars. It is possible that *Eochenus* is closer to *Tetracus* and *Galerix* rather than to *Tupaiodon*. Since most of the distinctive features of *Eochenus* appear primitive phylogenetically, *Eochenus* seems to represent the most primitive genus of the Galericinae so far known.

Tupaiodon huadianensis sp. nov.

Holotype A right lower jaw with P/4, M/1 and M/3 (V 8795).

Locality and horizon Loc. 85007, Daboji Oil Shale Mine, Gongjitun village; Member III of the Huadian Formation.

Diagnosis Intermediate between *Tupaiodon morrisi* and ?*T. minutus* in size, cheek teeth lower crowned with blunt cusps and ridges, P/4 having developed and more transverse paralophid with distinct paraconid and anteroconid, on M/1-3 anteroconid more or less distinct and metaconid lingual to protoconid, external cingulum well developed, trigonid of M/1 less compressed and less oblique, on M/3 paralophid shorter and curved and metaconid higher than protoconid.

Etymology Huadian, the name of the county where the fossils were collected.

Description The horizontal ramus of the lower jaw is long and slender with a straight lower margin. The mental foramen is below P/3. There are 8 alveoli before P/4. The first three may belong to three incisors. The fourth, the largest of them may be of C/1. The last two ones may be of P/3. The two alveoli between that of C/1 and P/3 may belong to P/1 and P/2 respectively.

P/4 is submolariform with well-developed trigonid. The developed paraconid joins the distinct anteroconid to form a transverse paralophid. The metaconid is also well-developed. The talonid is made of a transverse ridge which is as high as the paraconid.

M/1 is rectangular in outline. The trigonid is short. The paralophid is developed more transversely, with distinct paraconid and anteroconid. The metaconid is intermediate between the paralophid and protoconid in height. The metaconid lies lingually to the protoconid, and separated from the latter by a V-shaped valley, without forming a metalophid. The talonid is lower than the trigonid but broad, with a shallow hypoflexid. The external cingulum is continuous with anterior cingulum, but not with the posterior one that joins the posterolophid and extends along the external part of the posterior wall.

On M/3 the trigonid is oval in form, with very compressed and shallow basin. The metaconid is higher than the protoconid. The paralophid is curved, with more or less distinct paraconid and anteroconid on it. The hypoflexid is shallower than that on M/1.

Comparison and discussion Based on its principal features: complete dental formula, submolariform P/4, compressed trigonid of M/1 and lacking metalophid etc., V 8795 agrees

with *Tupaiodon*. It differs from the known species of *Tupaiodon, T. morrisi* and ?*T. minutus*, in having lower crowned cheek teeth, with blunter cusps and crests, more distinct paraconid and anteroconid, more transverse paralophid and higher talonid on P/4, less compressed and less oblique trigonid on M/1 and shorter and curved paralophid on M/3. V 8795 differs from *T. morrisi* in having developed cingulum. In its position of the mental foramen V 8795 also differs from ?*T. minutus*. V 8795 differs from *Ictopidium* in having lower cheek teeth crown, blunter cusps and crests, P/4 having more transverse paralophid and higher talonid, M/2-3 with low and curved paralophid, but without metalophid. It is obvious that most of the distinctive characters of V 8795 are primitive. It seems that V 8795 may represent a primitive species of *Tupaiodon*. It is called *T. huadianensis*.

The relationships between *Ictopidium* and *Tupaiodon*

Tupaiodon was established by Matthew and Granger (1924). In 1930, Zdansky described another new genus, *Ictopidium*, without comparing it with *Tupaiodon*. In 1969, while assigning his new species *tatalgolensis* to the genus *Ictopidium*, Sulimski compared *Ictopidium* with *Tupaiodon* and pointed out that the former differed from the latter in having different dental formula, a single-rooted canine and in lacking diastemas between the anterior lower teeth. Meanwhile he also suggested that ?*Tupaiodon minutus* might belong to *Ictopidium*. Later, Russell and Zhai (1987) even suggested *Ictopidium tatalgolensis* be the junior synonym of ?*Tupaiodon minutus*.

Having compared all the relevant specimens in detail, we found that *Ictopidium lechei* is very similar to *Tupaiodon*. In both forms the crown of P/3 is quite complex, P/4 is submolariform, M/1-3 have short and slightly oblique trigonid, M/2-3 lacking distinct anteroconid and on M/3 hypoconulid lies lingual to the longitudinal axis. Concerning Sulimski's opinion we would like to make the following comments:

First is about the dental formula of *Ictopidium lechei*. Zdansky (1930) thought it might be /? 1 4 3 and pointed out there must have been 2 incisors at least, and C/1 was reduced. Among the three alveoli between P/3 and C/1 the first large one might belong to P/1 and the other two might be of P/2. However Sulimski (1969) thought that the first three of all the 6 alveoli before P/3 belonged to incisors. The fourth one was of the canine. The next two might belong to one double-rooted tooth, P/2, therefore, P/1 must have been lost. Our observation does not totally substantiate Sulimski's interpretation. It seems to us that the anterior part of *Ictopidium lechei* is similar to that of *T. huadianensis*. We agree with Sulimski that the fourth large alveolus may belong to C/1. According to our observation in the living erinaceids, however, P/2 possesses double roots only when P/1 is present, and P/2 has usually only one root when P/1 is reduced. It seems that the two alveoli between C/1 and P/3 may belong to single-rooted P/1 and P/2 respectively rather than to one double-rooted tooth, P/2. It means that *Ictopidium lechei*, like *Tupaiodon huadianensis*, may have both P/1 and P/2.

Second is the number of the roots of the canine. *Tupaiodon* is known to have a double-rooted C1/, while *Ictopidium* has a single-rooted C/1. It is known that most genera of the Erinaceidae have double-rooted C1/ but singlerooted C/1. Therfore, the lower canines of *Tupaiodon* more probably have one root as well.

Finally, the diastemas between the anterior teeth of *Tupaiodon* do not differ widely from those in *Ictopidium*. In this case it appears reasonable to assign *Ictopidium lechei* to the genus

Tupaiodon. If the above proves true, *Ictopidium* would be junior synonym of *Tupaiodon*.

On the relationships between *Ictopidium tatalgolensis* and *I. lechei* and *?Tupaiodon minutus*

It is obvious that *I. tatalgolensis* is similar to *I. lechei* in cheek tooth structure. If *I. lechei* has P/2 but lost P/1, as Sulimski thought, it seems suitable to include *I. tatalgolensis* and *I. lechei* in the same genus *Ictopidium*. But if *I. lechei* has both P/2 and P/1, as mentioned above, it is possible that *I. tatalgolensis* may represent a distinct genus from *Ictopidium lechei*.

As for the relationship between *Ictopidiumtatalgolensis* and *?Tupaiodon minutus*, we think that, besides some similarities, there are still some differences between them: in *I. tatalgolensis* P/4-M/3 have developed metalophid, M/1 is much longer than P/4, M/3 is much smaller than M/2 and lacks hypoconulid. It is obvious that *I. tatalgolensis* should not belong to the same genus as *?Tupaiodon minutus*.

Soricidae (Fischer von Waldheim, 1817) Vicq d'Azyr, 1792
Ernosorex jilinensis gen. et sp. nov.

Holotype A left lower jaw with I/1-2, C/1 and P/4-M/1 (V 8796).

Locality and horizon Loc. 85007, Daboji Oil Shale Mine, Gongjitun village; Member III of Huadian Formation.

Diagnosis Medium-sized primitive soricid anterior part mandible less short, two mental foramina, dental formula /31 ?3 ?3; incisors procumbent and overlapped, I/1 large and bilobate, I/2 smaller, with four cusps on top, C/1 procumbent with main cusp at anterior end overlapping I/3, P/4 with triangular single-cusped trigonid and transversely crest-form talonid, M/1 has trigonid narrower than talonid, slightly compressed entoconid, entocristid connecting with metaconid, shallow hypoflexid and distinct hypoconulid from which posterior cingulum slops externally.

Etymology Ernos, Greek, Bud; Sorex, Greek, shrew, means it represents a primitive shrew. Jilin, the name of the province where the fossils were collected.

Description It is medium-sized. The horizontal ramus is thick, with straight lower border and two mental foramina below P/3 and P/4 respectively. The symphysis reaches the level of P/3 posteriorly. The anterior edge of the coronoid process is almost vertical. The dental formula is /31 ?3 ?3.

I/1 is large and procumbent and has a wide and anteroposteriorly compressed bilobate top slanting posteriorly, a thick and narrow lower part and 4 crests extending from the top to the base. The externolabial crest is swollen at its middle and there is a cusp on the externo-lingual crest.

I/2 is smaller than I/1 and with four cusps on the top. The cusps on the externo-labial crest is more distinct.

I/3 is lost but its alveolus is as large as that of I/2 and extends downwards and backwards.

C/1 is procumbent and has a main cusp on the anterior end overlapping I/3 and two small cusps along the posterior border. The main cusp is compressed and with anteiror and posterior crests. The single rubost root extends downwards and backwards below the posterior part of tooth.

There are three alveoli between C/1 and P/4 which may belong to a one-rooted P/2 and a double-rooted P/3. It seems that P/1 is reduced.

P/4 is triangular in outline and has a triangular single-cusped trigonid and a wide transverse ridge talonid.

M/1 is about triangular in outline with narrow trigonid and straight lingual border. The paralophid is straight. The metaconid is lingual to the protoconid, being high triangular in form. The entoconid is about equal to the metaconid in size, but slightly compressed, with weak entocristid joining the metaconid. The hypoflexid is shallow. The posterolophid is low and with a distinct hypoconulid on the middle. The anterior cingulum is distinct, but the posterior one slopes from the hypoconulid down labially behind the hypoconid.

The mandible between M/1 and the vertical ramus is broken, but the print on the matrix shows that M/2 is wider than M/1 and with equal wide trigonid and talonid. It is possible that the animal had a M/3.

Discussion

1. Phylogenetic position of *Ernosorex*

Ernosorex is more similar to Erinaceidae, Plesiosoricidae and Soricidae among Insectivora. Besides some features common to all the three families, *Ernosorex* possesses some other features similar to one or the other of the three families separately: 1) It is similar to Erinaceidae and Plesiosoricidae rather than Soricidae in having less shortened anterior part of the lower jaw and a distinct hypoconulid on M/1; 2) In the distribution pattern of the posterior cingulum it is similar to Erinaceidae and some soricids; 3) In having enlarged procumbent incisors, anteriorly inclined and overlapping anterior teeth it is similar to Soricidae and Plesiosoricidae, but different from Erinaceidae; 4) In P/4 having simple triangular single-cusped trigonid and M/1 with much narrower trigonid, compressed entoconid and connection of the entocristid with the metaconid it is similar to the Soricidae exclusively. It seems that the features common to *Ernosorex* and Erinasceidae and Plesiosoricidae but not to Soricidae are primitive. On the contrary, the features listed in 4) are typical for Soricidae and represent specialized ones. Therefore, *Ernosorex* and Soricidae seem to share common derived characters and are more closely related than with the other two families. Further, according to the features listed in 3) *Ernosorex* and Soricidae may form the sister group of the Plesiosoricidae. It appears that Ernaceidae is the remotest from *Ernosorex* among the three families.

2. The origin of the Soricidae

Saturninia is usually considered the closest to Soricidae among the primitive insectivores known. Although Stehlin (1940) thought that *Saturninia* is intermediate between Soricidae and other insectivores in many features, he did not consider it the ancestor of the Soricidae. In his memoir on Soricidae, Repenning (1969, p. 58) said: "There is no shrew known that is sufficiently generalized morphologically to be this common ancestor". However he made a tentative suggestion as to the diagnostic features of the supposed soricid ancestor. Having compared Repenning's diagnosis for his hypothetical ancestor with that of *Ernosorex* we found the both were quite similar in many characters, except that *Ernosorex* still had some more primitive features, such as having hypoconulid on molars, and lacking of some advanced ones. *Ernosorex* thus appears to be a primitive form of Soricidae and is better to be assigned in the

Soricidae. In this case, it indicates not only that Soricidae might appear early in late medial Eocene in Asia, but also that Soricidae might originate in Asia and then migrate to North America and Europe. On the other hand, it appeared too late to be considered as direct ancestor of Soricidae.

Primates Linnaeus, 1758

Omomyidae Trouessart, 1879

Omomyinae Trouessart, 1879

Asiomomys changbaicus gen. et sp. nov.

Holotype A right lower jaw with P/3, M/2 and M/3 (V 8802).

Locality and horizon Loc. 85006, Gonglangtou Oil Shale Mine; Member III of Huadian Formation.

Diagnosis Close to *Omomys powayensis* in size and morphology, P/3 single-cusped, double-rooted; M/2-3 very low crowned, with very low and blunt cusps and weak crests, trigonid very low and compressed anteroposteriorly with very narrow basin, developed paraconid situated at the middle of anterior border, metalophid incomplete, talonid basin long, broad and shallow with small hypoconulid and shallow hypoflexid.

Etymology Asiomomys = Asia + Omomys; Changbai, the name of the mountain into the demain of which the fossil site falls.

Description The horizontal ramus of the mandible possesses a straight lower margin and a mental foramen below P/4. The anterior margin of the coronoid process is crossed with the dental margin of the horizontal ramus at about 60°. The large masseteric fossa extends nearly to M/3. The angular process extends backwards.

P/3 is composed of a simple triangular single-cusped trigonid and a transverse crest-form talonid, with double roots.

M/2 is trapezoid in outline with very low crown. The trigonid is very compressed anteroposteriorly and low, with very low and blunt main cusps and weak crests. The paraconid stands at the middle of the anterior side of the tooth, just opposite the valley formed by the protoconid and metaconid. The very low paralophid connects the paraconid with the protoconid. The metaconid is V-shaped, with its anterior arm forming a right angle with the metalophid. The metalophid is interrupted at its middle. The trigonid basin is very small and has a posterior notch. The talonid is slightly lower than the trigonid. The hypoconid is the largest cusp of the tooth, with an oblique cristid extending almost along the labial border, therefore, the hypoflexid is very shallow. The entoconid is also developed but lower than the hypoconid and with distinct preentoconid and preentoconid cristid. The very low posterolophid is worn into a concave surface and slightly widens in its central part, which may represent a vestige of the hypoconulid. The talonid basin is very broad and shallow with weak enamel wrinkles. The cingulum is developed along the external wall and the external halves of the anterior and posterior walls.

M/3 is longer but narrower than M/2. The trigonid is shorter and lower with lower cusps and crests. The paraconid is separated from the paralophid. There is an isolated accessory cusp between the paraconid and anterior arm of metaconid. The trigonid basin is shallower, widely opened posteriorly. The hypoconid and entoconid are low and compressed

transversely, both stand marginally. The hypoconulid is very large and worn down to form a lunar groove. The oblique cristid extends along the labial border, therefore, the hypoflexid is shallower. The talonid basin is broad with distinct wrinkles on it.

Comparison and Discussion *Asiomomys* is similar to late omomyines, such as *Omomys* (Bridgerian-Uintan), *Utahia* (Uintan), *Chumashius* (Duchesnean) and *Dyseolemur* (Uintan), in basic structures. Among them *Asiomomys* is closer to *Omomys*, particularly *Omomys powayensis*. It differs from *O. powayensis* in having lower trigonid, shallower talonid basin, lower and blunt cusps and weak crests. Besides, it differs from other species of *Omomys* in having compressed trigonid and the central position of paraconid. It differs from *Utahia* in having lower trigonid, developed paraconid and shallow hypoflexid; from *Chumashium* in having compressed trigonid, developed paraconid, long talonid basin and shallow hypoflexid; and from *Dyseolemur* in having narrower molars, low trigonid, longer talonid basin, shallow hypoflexid and less reduced M/3. It seems that the distinctive features of *Asiomomys* from *Omomys powayensis* are progressive. *Asiomomys* possibly represents a little more advanced form than *Omomys powayensis*.

The Omomyidae has been known to distribute in Europe and North America in Eocene and Oligocene and the Omomyinae has been found only in North America. Recent discoveries show that omomyids lived also in Asia. There are *Huanghonius* (M.-L. Eocene, Shanxi, China), *Altanius* (E. Eocene, Mongolia), *Kohatius* (E.-M. Eocene, Pakistan). Recently, Szalay and Li (1986) argued that *Decoredon*[1] from Middle Paleocene of China might also be a member of the Omomyidae and suggested that the Primates originated from Asia rather than from Africa, then dispersed into North America and Europe, subsequently suffered extinction in Asia. The discovery of *Asiomomys* from Huadian Formation not only substantiates that the Omomyinae did live in Asia, but also proved that the Omomyidae did not become extinct so early in Asia as it was thought.

Rodentia Bowdich, 1821

Sciuravidae Miller et Gidley, 1918

Zelomys gen. nov.

Type species *Zelomys orientalis* sp. nov.

Diagnosis Close to *Sciuravus bridgeri* in size, protrogomorphous skull and sciurognathous lower jaw, single mental foramen below P/4, dental formula /1 0 1 3; cheek teeth increase in size from P/4 to M/3, brachyodont with distinct but low crests, narrow trigonid with developed anteoconid, broad talonid basin with distinct mesostylid, complete ectolophid, developed mesoconid and enamel wrinkled; on lower molars anterior arm of protoconid reaches anterior cingulum, metalophid I developed, metalophid II long and connected with metaconid on M/1-2, but short and without reaching metaconid on M/3; M/1-3 have mesolophid and transverse developed hypolophid joining anterior arm of the hypoconid, distinct hypoconulid, and developed posterolophid and anterior cingulum, enamel wrinkled.

Etymology Zelos, Greek, zealous, it is their zealous effort that makes the discovery

1) Szalay et Li (1986) arranged *Diacronus anhuiensis* in genus *Decoredon* and considered *Diacronus anhuiensis* and *Decoredon elongatus* belong to the same species and designated *D. anhuiensis* as the legitimate name. However, because the type species of *Decoredon* is *D. alongatus* Xu, 1977, rather than *D. anhuiensis*, the valid name should be *D. elongatus*.

possible.

Zelomys orientalis sp. nov.

Holotype A left lower jaw with I/1 and P/4-M/3(V 8797).

Referred material A left lower jaw with M/1-3(V 8798) and a part of a skull (V 8799).

Locality and horizon Loc. 85007(V 8798 and V 8799), Daboji Oil Shale Mine, Gongjitun village and Loc. 85006(V 8797), Gonglangtou Oil Shale Mine; Member III of Huadian Formation.

Diagnosis Horizontal ramus rubost and high with shorter diastema, I/1 thick and strongly curved, P/4 with coniform protoconid without metalophid II, hypolophid joins hypoconulid forming a very small posterior fossettid.

Etymology Orientalis, Latin, eastern.

Description The horizontal ramus is thick and high with short diastema. The mental foramen is below P/4. The masseteric fossa reaches the level of M/2. The angular process is sciurognathous. The dental formula is /1 0 1 3. The cheek teeth are brachyodont with distinct but low crests. The cheek teeth increase from P/4 to M/3.

I/1 is thick, strongly curved, with oval section and dendritic veins on enamel.

P/4 is trapezoid in outline with a wide talonid. The small trigonid is higher than the talonid, without distinct metalophid II. The protoconid and metaconid are coniform and close to each other in size. The distinct anteroconid reaches protoconid. The trigonid basin is very small and opens both anteriorly and posteriorly. The entoconid is equal to hypoconid in size. The ectolophid is complete but low, with mesoconid. The hypolophid extends postero-externally to join the hypoconulid. The posterolophid is very short and the postsinusid is very small.

M/1 is trapezoid in outline. The trigonid is very short and narrow and slightly higher than the talonid. The metalophid I is developed and reaches the anterior arm of the protoconid, connecting the anteroconid with the protoconid. The long metalophid II reaches the metaconid, thus closing the trigonid basin. The lingual part of the anterior cingulum extends horizontally while the labial one slopes down steeply. Both the anterosinusid and protosinusid are shallow. The hypolophid transversely extends to the anterior arm of the hypoconid. The distinct ectolophid may or may not join the hypoconid. The mesoconid is developed with a short mesolophid. The mesostylid is usually distinct. Both the hypoconulid and posterolophid are developed. The talonid basin is broad with enamel wrinkles.

M/2 is wider than M/1 in proportion. The trigonid is short. The labial end of the metalophid I curves anteriorly to join the anterior cingulum. Therefore the anterosinusid is smaller and shallower, but the protosinusid is deeper. The mesolophid is forked and the anterior cingulum is more developed.

M/3 is longer but narrower than M/2. The metalophid I is shorter and its joint with the anterior cingulum moves lingually, so that the anterosinusid becomes smaller and even disappears. The metalophid II shortens and does not reach the metaconid, therefore, the trigonid opens posteriorly.

Although only the anterior part of the skull is preserved which is compressed strongly, the skull coincides with the type specimen (lower jaw) in size and incisor features. There is small infraorbital foramen and a distinct scar of the masseter muscle on the base of the jugal. The upper incisor is oval in section and has veiny enamel.

Zelomys gracilis sp. nov.

Holotype A right lower jaw with I/1, P/4-M/2(V 8800).

Paratype A left lower jaw with P/4-M/1(V 8801).

Locality and horizon Loc. 85006, Gonglangtou Oil Shale Mine; Member III of Huadian Formation.

Diagenosis Horizontal ramus thin, with long diastema and thin, less curved I/1; less thick cheek teeth; P/4 has V-shaped protoconid, high metaconid and developed metalophid II, hypolophid extends transversely to anterior arm of hypoconid, mesolophid of M/2 unforked.

Etymology gracilis, Latin, thin, means the lower jaw and incisors are thinner than those in the type species.

Description and comparison *Zelomys gracilis* is close to *Z. orientalis* in size, but with thinner lower jaw and longer diastema. The height of the horizontal ramus is about 2/3 of that of *Z. orientalis*. The lower incisor is also thinner and less curved, with dendritic veins on enamel. P/4 has a high trigonid and even higher metaconid. The V-shaped protoconid has developed metalophid II joining the protoconid with metaconid, and developed anterior arm reaching the distinct anteroconid. The ectolophid is complete but low, with distinct mesoconid. The hypolophid transversely extends to the anterior arm of the hypoconid. On M/1-2 the anteroconid is more distinct and the enamel is more wrinkled.

Discussion Systematic position of *Zelomys*:

According to its protrogomorphous skull *Zelomys* should be arranged in Protrogomorpha. In this suborder *Zelomys* agrees with Sciuravidae not only in the morphology of the skull, lower jaw and dental formula, but also in the tooth structure, such as the brachyodonty, the lower trigonid, double metalophids, developed anteroconid, mesoconid, hypolophid and the distinct ectolophid and hypoconulid. In the Sciuravidae *Zelomys* resembles *Sciuravus* rather than *Tillomys, Pauromys, Knightomys* and *Dawsonomys* in having anterior arm and longer posterior arm of protoconid, complete ectolophid and hypolophid joining the ectolophid in front of the hypoconid, and mesolophid. It differs from *Sciuravus* in having thinner crests and cusps, having developed cingulum extending horizontally, more developed metalophid I extending to anterior cingulum, and enamel wrinkles. All these features are apparently derived. *Zelomys* appears to represent an advanced genus of the Sciuravidae.

It should be pointed out that *Zelomys* is similar to *Namatomys* from the Chadronian of North America, in lower jaw and cheek tooth features, such as the short diastema and deep mandible, P/4 with anteroconid, M/1-3 having developed anterior cingulum joining anterior arm of protoconid, having anterior arm of protoconid, metalophid I and metalophid II and short mesolophid. *Namatomys* differs from *Zelomys* in being smaller in size, having short hypolophid extending backward to posterolophid and shorter posterosinusid on M/1-2, and M/3 being much reduced in size without hypolophid. According to the similarities mentioned above *Zelomys* and *Namatomys* seem very close morphologically. However, *Namatomys* has been arranged in Eomyidae, while *Zelomys* is not to be referred to Eomyidae based on its protrogomorphous skull. Is it possible that *Namatomys* does not belong to Eomyidae at all? As a matter of fact, while including *Namatomys* in Eomyidae Black stressed (Black, 1965, p. 39—40) that in *Namatomys* "the double metalophid condition would appear .. to be of rather fundamental importance, thus removing *Namatomys* from any close relationship to the other

early Oligocene eomyids". Wood (1980, p. 36—40.) agreed with Black on this point. Our observation seems to prove that it is this "double metalophid condition" that makes *Namatomys* very similar to *Zelomys* and some other sciuravids. Therefore, it is possible that *Namatomys* also belongs to Sciuravidae as *Zelomys* does. *Namatomys* would remain in Eomyidae if *Namatomys* proves to have a myomorphous skull; The other alternative can not be excluded that *Zelomys*, and *Namatomys* also, belong to a family other than Sciuravidae, if V 8799 (edentulous skull) proves in the future not to belong to the *Zelomys* type specimen (lower jaw), or the upper cheek tooth features of *Zelomys* and *Namatomys* are quite different from those of the Sciuravidae.

So far it has been known that the Sciuravidae distributed exclusively in Eocene of North America. Although some Asian genera, such as *Tamquammys*, *Saykanomys*, *Advenimus*, *Tsinlingomys*, *Terrarboreus*, *Petrokozlovia* and ?*Sciuravus* sp. Li, 1963, had been variously assigned to the Sciuravidae, they are not true sciuravids. In fact they are ctenodactyloids. However, the discovery of *Zelomys* seems to indicate that the sciuravid did live in Asia, if *Zelomys* is a genuine sciuravid. The Asian form was probably an immigrant from the North America.

Discussion

1. The age of the Huadian site as evidenced by its mammalian fauna

The oil shale mine of Huadian County was first reported by Nisida (1940) as of Jurassic-Cretaceous. Later, according to fossil plants Minagawa (1943) assigned its age to Paleogene. Then in 1946 Suzuki thought of the age as Eocene based on gastropod fossils. Since then no progress in this field had been made until 1986 when Zhou and Sun suggested the age be Early Eocene based on their fossil fish.

Turning now to the mammalian fauna, we may first deal with the rodent *Zelomys*. It is known that the last occurrence of *Sciuravus*, the latest sciuravid, is in the lower part of Uintan in North America. As mentioned above, *Zelomys* may represent an advanced sciuravid and immigrant from North America. On the other hand, *Zelomys* appears to be a little more primitive than *Namatomys* from the Chadronian in having less reduced M/3. This suggests strongly that the age of Huadian fauna may fall between those of the early Uintan and the Chadronian. In other words, its age may be late Uintan or late Eocene.

It is about the same with the primates. Among the Omomyinae *Asiomomys* is closer to the Early Uintan *Omomys powasyensis*, but slightly advanced. The age of *Asiomomys* may be the same as that of *Omomys powayensis*, i.e. Uintan, or later.

Huadian mammalia fauna includes three insectivora genera. Among them *Eochenus* may represent the most primitive galericine. It is more primitive not only than *Tupaiodon* from M. Oligocene of Asia and *Tetracus* (E.-M. Oligocene), the earliest galericine of Europe, but also than *Ictopidium* from the Zhaili Member (late medial-late Eocene) of China. Similarly, *Tupaiodon huadianensis* is also more primitive than M. Oligocene *T. morrisi* and ?*T. minutus*, and *Ictopidium lechei*. According to both *Eochenus* and *Tupaiodon huadianensis*, the age of the fauna must be earlier than or equivalent to that of the Zhaili member. As far as the Soricidae are concerned, the earliest known genus of the Soricidae, *Domnina*, made its first appearance in late Uintan. Since then the Soricidae have differentiated widely. If it is true that *Ernosorex* represents the most primitive form of the Soricidae, the age of the occurrence of *Ernosorex*

should probably be earlier.

In conclusion, according to the mammalian fauna, the age of the Huadian Formation may fall in the interval from Uintan to Chadronian in North America biostratigraphy. More exactly, it may be equivalent to late Uintan or late Eocene.

2. The relationships of Huadian mammalian fauna with North American and European ones

As mentioned above the Huadian Mammaian Fauna includes two forms that used to be known to occur in North America only, the Omomyinae and Sciuravidae. Although there are no genera common to Asia and North America, it is obvious that Huadian forms, *Asiomomys* and *Zelomys*, resemble the North American forms very much. It indicates that around the late medial Eocene some faunal exchange existed between Asia and North America indeed, but no such occurred between Asia and Europe. The exchange between Asia and North America took place probably directly rather than via Europe.

The Paleogene galericines are known to be found only in Asia and Europe. In North America they made their first appearance in middle Miocene. The Age of the first European form, *Tetracus*, is early Oligocene, while *Eochenus*, the most primitive galericine, occurred in late medial or late Eocene of Asia. If there was some exchange between Asia and Europe as evidenced by the galericines, it might happen much later. The European galericines might immigrate from Asia after the "Grande Coupure", not in Eocene.

The relationships of the Asian soricids with the North American and European ones are also interesting. It is known that the first North American soricid, *Domnina*, occurred in late Uintan, while the first European form, *Trimylus*, occurred in early Oligocene. If it is true that *Ernosorex* represents the most primitive form of the Soricidae, it seems possible that the Soricidae might originate from Asia and migrated at first into North America in Uintan age, and then into Europe in early Oligocene. It demostrates that the connection of Asia with North America and Europe varied as the time went on.

3. The Paleoenvironment of the Huadian Basin

The living galericines, such as *Echinosorex* and *Hylomys*, are inhabitants of moist forest area in South Asia. Although the living soricids are found on all major land areas, they usually inhabit only moist areas, including forest, shrunbgrown tracts. Similarly, most of the living primates inhabit tropical, subtropical or temperate forest, while *Tarsiurs*, the living relative of the Omomyidae, inhabits secondary or scrub jungle, usually at low altitudes, and preys mainly on insects. According to the living animals all the mammals found in Huadian Basin seem to be forest inhabitants. In addition, most of the fossils other than mammals, such as fishes, Threskiornithidae, Anatidae and Gastropoda, are forms living in or near the water, while most of the spore-pollen fossils represent the plants growing in warm and moist forest area. Besides, the abundent oil shale and coal deposits seem to indicate a forest-swamp landscape as well.

Conclusion

1. The Huadian mammalian fauna, the first Paleogene mammalian fauna in Northeast

China, is probably equivalent to late Uintan of North America or late Eocene in age.

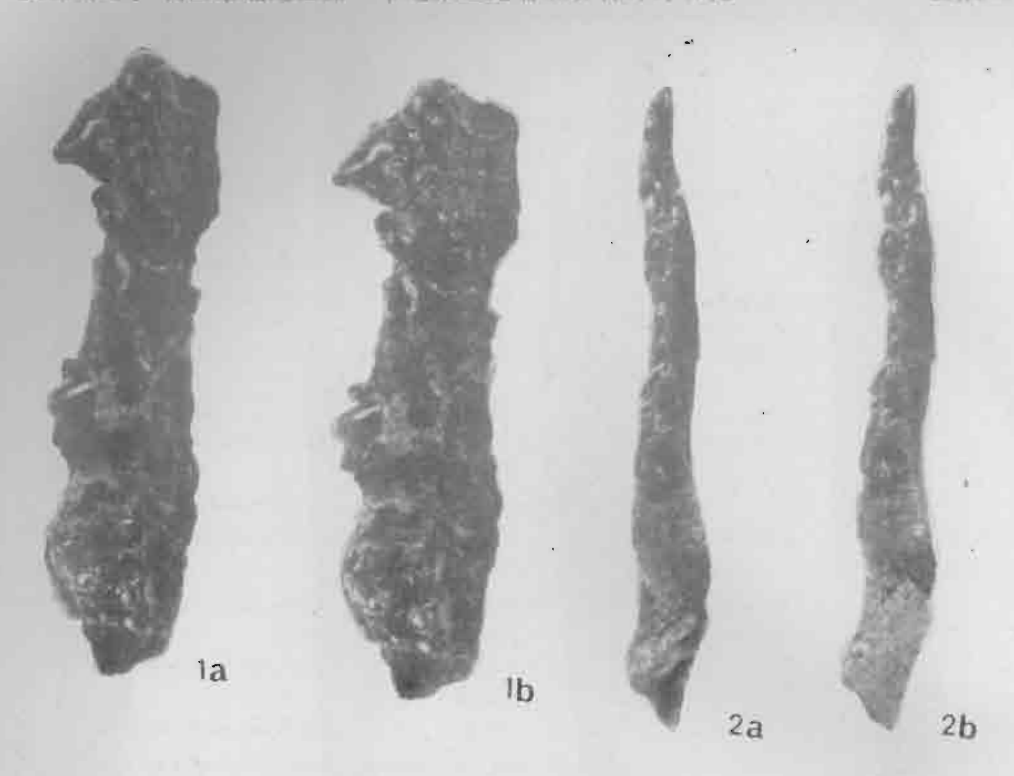
2. The Huadian Mammalian fauna is mainly composed of micromammals being forest inhabitants. The landscape of the Huadian Basin area in late medial Eocene might be a kind of forest-swamp under warm and moist climate.

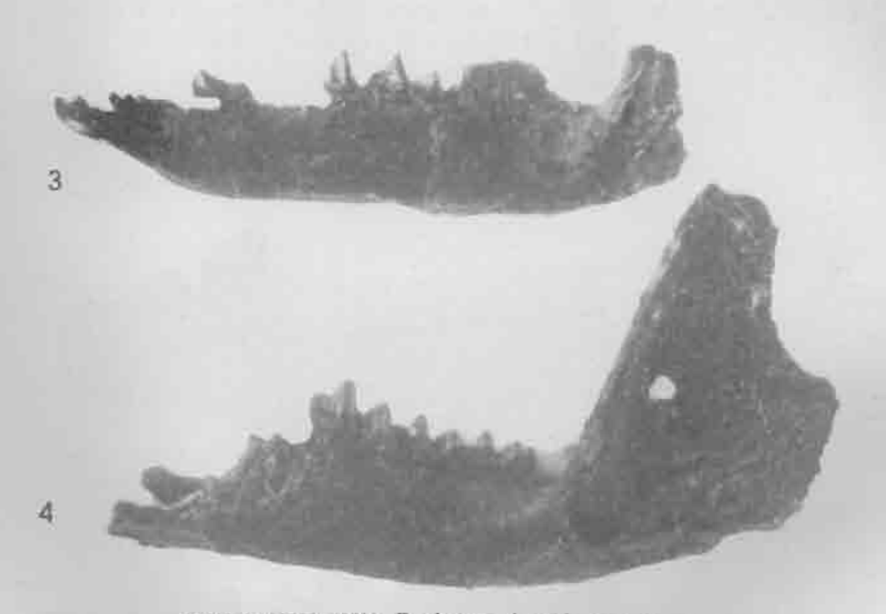
3. The Huadian mammalian fauna shows closer relationship to that of North America rather than to Europe. Direct exchange between Asia and North America might occur in late medial Eocene. The Soricidae might originate from Asia and migrate into North America, while the sciuravids might be immigrants from North America into Asia.



中华晓猬（新属、新种）*Eochenus sinensis* gen. et sp. nov. ×5

1,3：正型标本：左下颌骨具 I_{2-3}、C 和 P_1-M_3 (holotype: left lower jaw with I_{2-3}, C & P_2-M_3), V8786；2,4：右下颌骨具 P_2-M_3 (right lower jaw with P_1-M_3), V8787；1,2：嚼面观、立体照片 (occlusal view, stereographs)；3,4：唇面观 (labial view)





中华晓猬（新属、新种） ***Eochenus sinensis*** **gen. et sp. nov.** ×5

1，右上颌骨具 C, P^3, P^4 和 M^{1-2} (right maxilla with C, P^3, P^4, M^{1-2}), V8793;

4. 左下颌骨具 M_{1-3} (left lower jaw with M_{1-3}), V8789

吉林晢鼩（新属、新种） ***Ernosorex jilinensis*** **gen. et sp. nov.** ×5

2，3：正型标本：左下颌骨具 I_{1-2}, C, P_4-M_1 (holotype: left lower jaw with I_{1-2}, C & P_4-M_1), V8796

1，2：嚼面观，立体照片 (occlusal view, stereographs);

3，4：唇面观 (labial view)



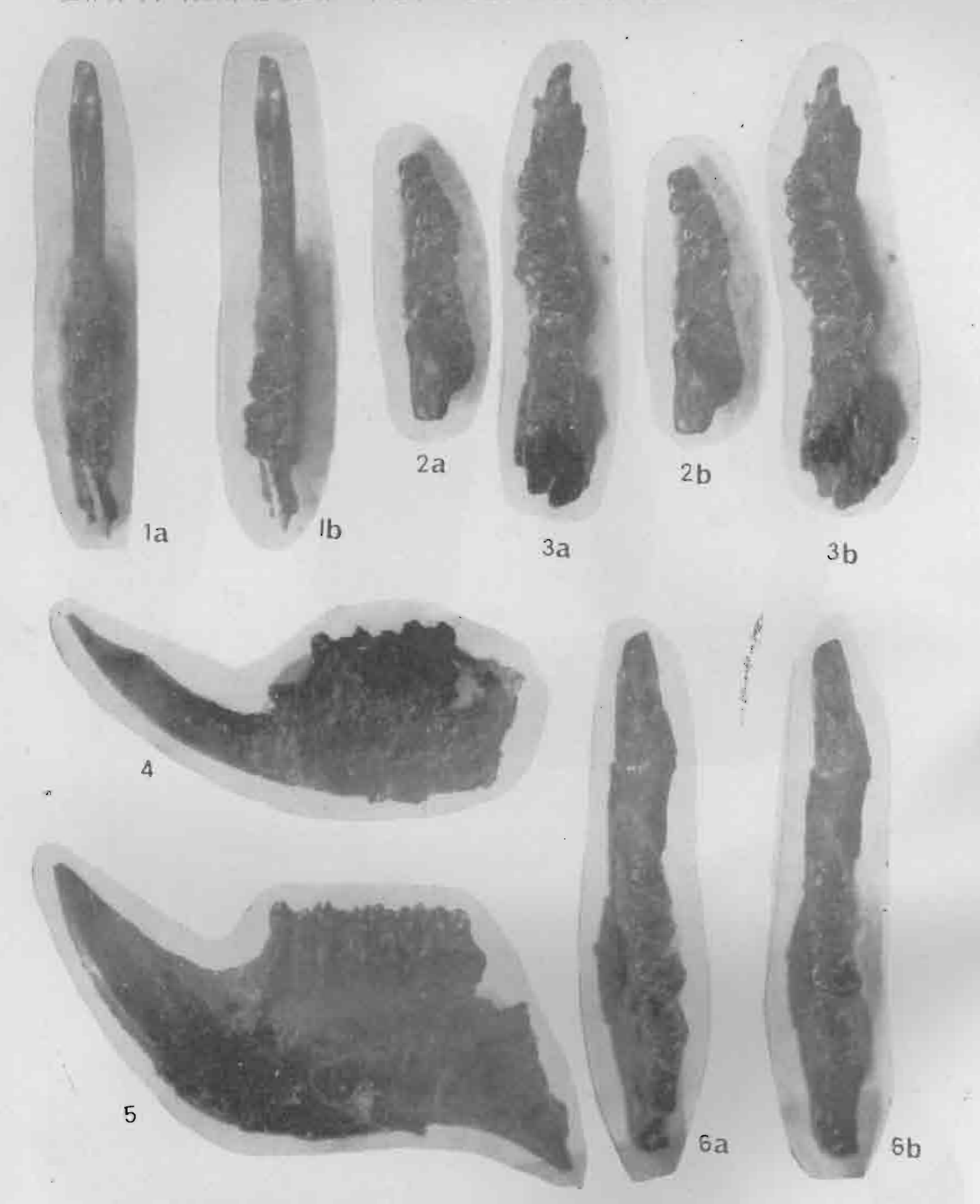
桦甸齿鼩猬(新种) ***Tupaiodon huadianensis*** **sp. nov.** ×5

1,2：正型标本：右下颌骨具 P_4、M_1 和 M_3 (holotype: right lower jaw with P_4, M_1 & M_3), V8795

长白亚洲镜猴(新属、新种) ***Asiomomys changbaicus*** **gen. et sp. nov.** ×5

3,4：正型标本：右下颌骨具 P_4 和 M_{2-3} (holotype: right lower jaw with P_4 & M_{2-3}), V8802

1,3：嚼面观，立体照片 (occlusal view, stereographs)；2,4：唇面观 (labial view)



纤细争胜鼠(新属、新种) ***Zelomys gracilis*** **gen. et sp. nov.** ×5

1,4: 正型标本: 右下颌骨具 I_1, P_4–M_2 (holotype: right lower jaw with I_1 & P_4–M_2), V8800;
2: 左下颌骨具 P_4–M_1 (left lower jaw with P_4–M_1), V8801

东方争胜鼠(新属、新种) ***Zelomys orientalis*** **gen. et sp. nov.** ×5

5,6: 正型标本: 左下颌骨具 I_1 和 P_4–M_3 (holotype: left lower jaw with I_1 & P_4–M_3), V8797;
3: 右下颌骨具 M_{1-3} (right lower jaw with M_{1-3}), V8798
1,2,3,6: 嚼面观，立体照片 (occlusal view, stereographs);
4: 舌面观 (lingual view); 5: 唇面观 (labial view)